SCIENTIFIC AMERICAN

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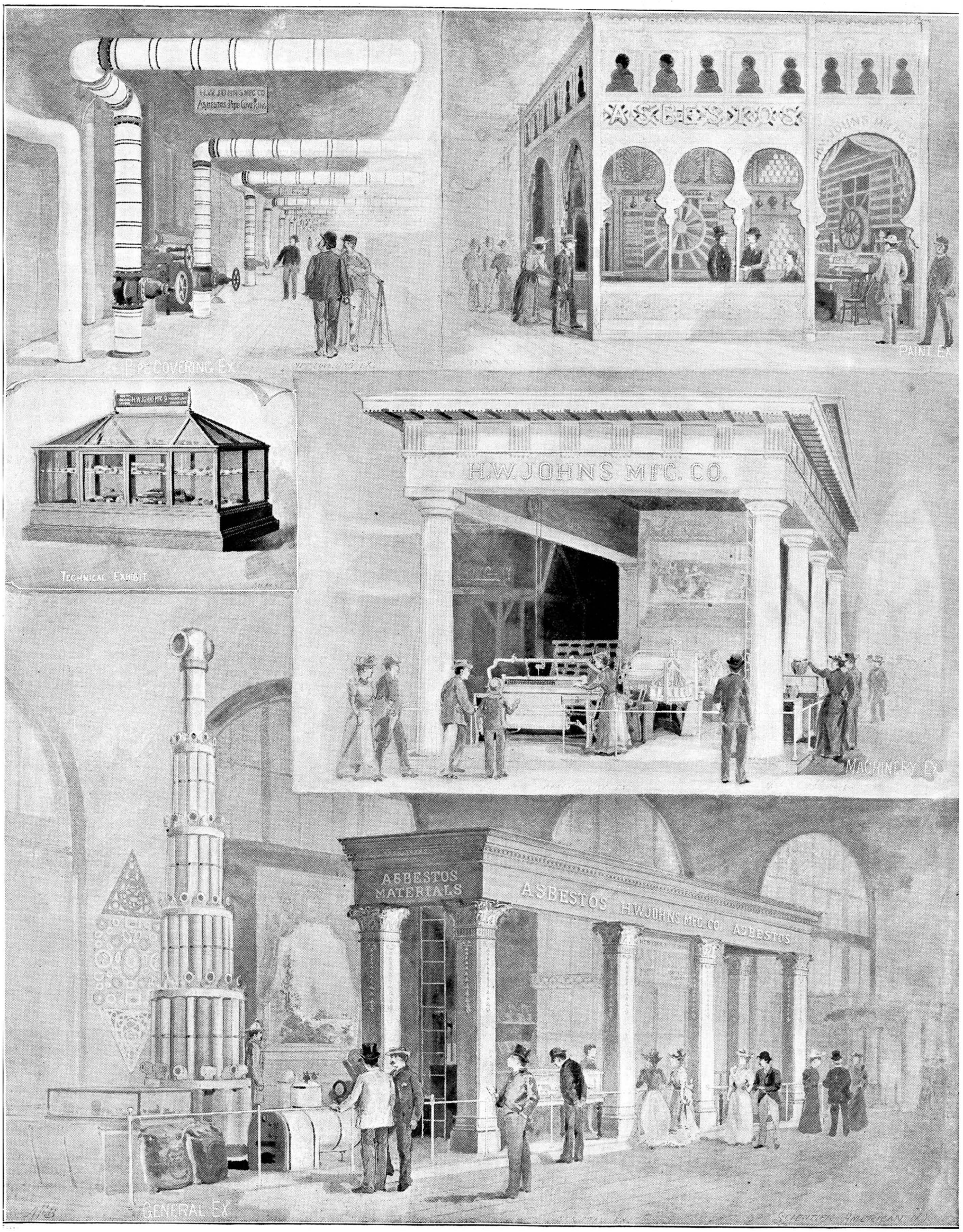

THE WORLD'S COLUMBIAN EXPOSITION—THE H. W. JOHNS MANUFACTURING COMPANY'S VARIOUS EXHIBITS.—[See page 215.]

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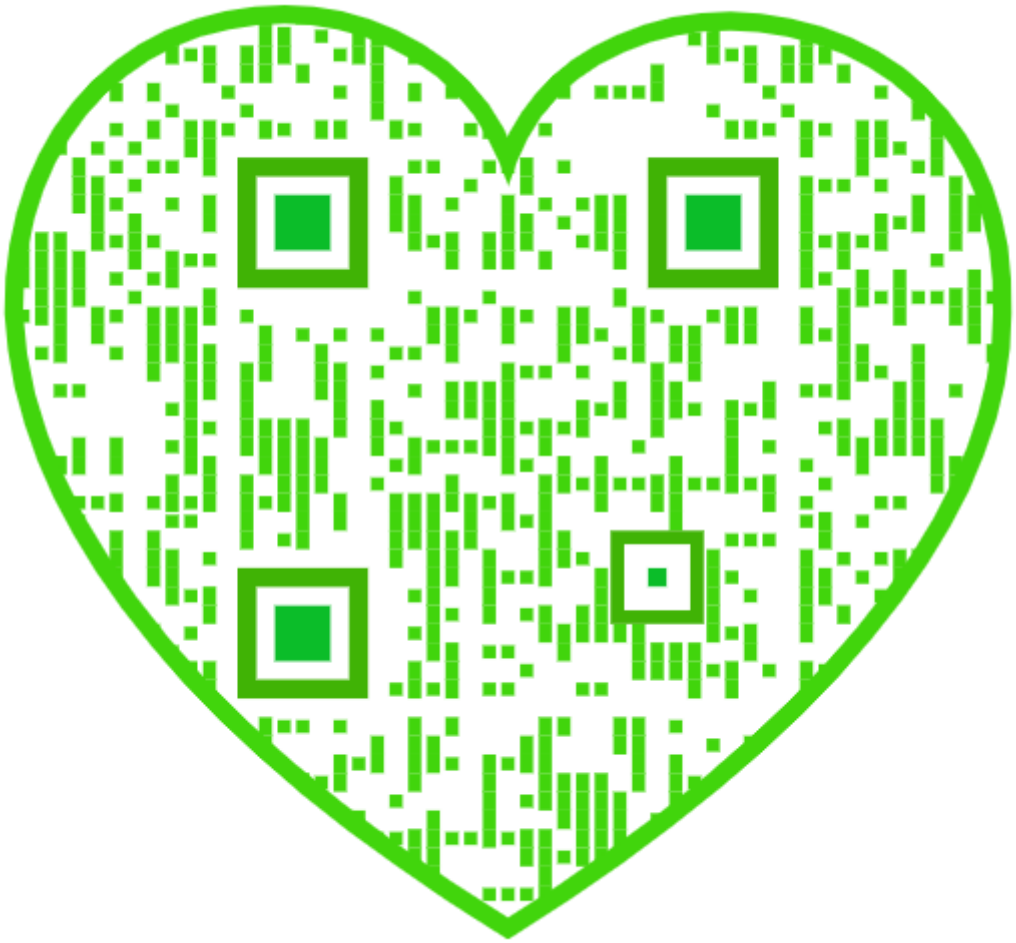

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THE NEW CUNARD STEAMERS.

The two new additions to the Cunard fleet of steamers, plying between New York and Liverpool, the Campania and the Lucania, are now distinguished as the largest and finest vessels of their kind in the world. The Lucania has just completed her first round voyage and made a great record for speed. Daily runs of 460, 490, 498, 516, and 533 nautical miles per day were made. The Campania has even reached 548 nautical miles in a day.

The Campania and Lucania are as nearly as possible twins. They are each 600 feet in length between perpendiculars. Length over all, 620 feet; breadth, 65 feet 3 inches; depth to upper deck, 43 feet; gross tonnage, 12,500 tons.

They are each fitted with two sets of the most powful triple expansion engines that have yet been constructed, each set capable, it is believed, of indicating from 14,000 to 15,000 horse power. These engines are fitted in two separate engine rooms, there being a dividing center line bulkhead between them, fitted with watertight doors for the necessary purposes of communication. Each set of engines has five inverted cylinders—two high pressure, one intermediate pressure, and two low pressure cylinders, the two high pressure being placed tandem wise above the low pressure ones. These are arranged to work on three cranks, set at an angle of 120 degrees. The high pressure cylinders are each fitted with piston valve, the intermediate and low pressure with double piston valves, all of which are worked by the usual double eccentrics and link motion valve gear. Steam from the two high pressure cylinders exhausts into the intermediate one, which in turn exhausts into the two low pressure cylinders, which have relieved slide valves, expansion taking place in three stages.

Steam for the main engines is generated in twelve large double-ended boilers, each having eight corrugated furnaces. The boilers are arranged in two groups of six, each group self-contained in water-tight compartments, and having a common funnel of the unprecedented diameter of 21 feet. The two funnels, it may be added, are from their lowest section 120 feet high, or about the height of the Eddystone Lighthouse. There is also a large single-ended boiler for supplying steam for the electric light, refrigerating and other auxiliary machinery. In addition, a small single-ended boiler is fitted on the lower deck for supplying steam to the distilling condensers, heating pipes, etc. An elaborate system of piping is fitted throughout the ship, and connected to the various auxiliary pumps for filling and emptying the ballast tanks, pumping out bilges, pumping water on deck in case of fire, and other purposes.

The interior fittings of the vessels are most luxurious. Four hundred and sixty saloon passengers, 180 second cabin and 540 steerage passengers can be accommodated. An attempt has been made to bring the surroundings up to the level, in point of comfort, of the first class hotel. No expense has been spared to give the portion of the vessel devoted to the saloon passengers the utmost elegance. High prices are charged for passage on these flying palaces of the ocean; nor is this to be wondered at, as the running expenses are enormous. Each ship burns about 500 tons of coal per day, in ninety-six furnaces, and to keep them a-going requires a small army of stokers.

MUSHROOM POISONING.

Within the last few weeks several very serious cases of mushroom poisoning have been chronicled by the daily press. In the literature of the subject of mushrooms there may be found a most vivid description of the agonies endured by one who was nearly killed by mushroom poisoning. There is every reason to believe that the sufferings of some (if not all) of the unfortunate victims referred to were very great, independent of the fatal results. It is a very common practice to distinguish between mushrooms and toadstools, the latter name indicating presumably any kind of fungus of the mushroom shape, other than the ordinary edible one. Another popular practice is to assume the validity of some simple test, independent of eating it, to determine the edibility of a fungus. Both these ideas are quite wrong. No distinction between mushroom and toadstool is admissible, and the mushroom gatherer of this vicinity confining his harvest to the field mushroom, or *Agaricus campestris*, often passes over other mushrooms which are perfectly edible but of whose innocuousness he has no assurance.

The mushrooms proper are classified largely by the nature of the under surface of the head. In the *Agaricus* division this part is filled by radial plates, familiar to us all in the ordinary mushroom. In other divisions this part has a different structure. The number of varieties is very great and the number of edible varieties is also far greater than usually supposed. The assumption that there is a universal and simple test other than eating for mushrooms is an error. One of our leading chemists, a great lover of mushrooms, adopted the following test for mushrooms: To determine whether an untried fungus was edible he would cook and eat a piece the size of a silver dime; if this produced no effect, he would prepare and eat a piece as large as a silver dollar; if this produced no effect, he would consider that fungus a safe one. The fact of the case is that the only way to know whether a fungus is edible or not is to distinguish it by its appearance; in other words, to know it when seen.

One of the troubles incident to the determination of the edible species is that in the *Agaricus* division, characterized by the radial plates formed in the under surface of the head, some of the most poisonous species fall.

Hence this identification by the radial plates in itself is of practically no value and might lead to dangerous results. One system of testing consists in ascertaining if the suspected fungus will discolor a silver spoon; this test is absolutely without value. It is also probable that any chemical test which may be devised for determining the presence of the poisonous alkaloid will yield in simplicity and in directness to the simple identification of the species found.

In different parts of the world different mushrooms are selected for eating, varying greatly in flavor and other qualities. Here the field mushroom seems most in demand, as only a few experts ever go outside of the one individual species. The moral of the whole matter is that in gathering mushrooms care should be taken and absolutely no doubt should be allowed to exist as to the identity of the species collected. Experience not only proves the danger incident to mushroom gathering, but it also shows the perfect ease with which the proper fungus can be identified even by children.

HEALTH RULES IN SIX WORDS.

Strict temperance.
Correct diet.
Systematic exercise.

AUTOMATIC SAFETY APPLIANCES RECENTLY INTRODUCED ON A NEW YORK RAILROAD.

I note with interest what you say in the current number of the SCIENTIFIC AMERICAN about railroad signals, having given much attention to the subject and written a great deal upon it. It seems to me that the very features which you demand in a perfect system are now working in one recently put in by one of the most conservative and best managed railroads in the country, where it crosses the Western New York & Pennsylvania in the outskirts of Buffalo. I lately examined this, in company with the chief engineers of two roads, and my two companions were loud in their praises of it. The transmitting power is compressed air at about fifteen pounds pressure, and the mechanism in the hands of the towerman is a single lever, requiring a force of ten pounds to throw it. When this lever is upright, the distance semaphores at 1,000 feet and the home ones at 500 are at danger in all four directions, and a double-jointed shoe is raised six inches in the center of the track opposite the home semaphore. If the engineer passes the home semaphore when at danger this shoe strikes a lever hinged to the forward truck frame of the locomotive, which in turn opens a cock in the air pipe, setting the brakes on the train. A hundred feet inside the home signal is a derailing point, which the locomotive would take if, by any failure of the air brakes, it reached that place. By throwing the lever in the tower to the right, the air brake shoe and semaphores fell and the derailing point closed on one line, but on the other remained as they were. The train on the open line advanced a few feet beyond the home signal, when the tread of the wheels pressed down a detector bar on the outside of the rail, which through pneumatic pressure locked the mechanism in the tower, so that while the signalman could bring his lever back to the upright position, thus setting the danger signals behind the train to prevent a rear end collision, he could move it no further, and it was absolutely impossible to open the other road to a train until after the one to which the crossing had been given had been cleared.

The air is conveyed in pipes, and there is a small cylinder, with plunger and piston, at each point where its force is to be exerted. The strong feature of this system is that when one road is closed the other is absolutely and effectually closed mechanically, and beyond the efforts of an excited or careless towerman to open it. The system is applicable to the approach of drawbridges and to the "blocking" of roads, in the latter case the train mechanically raising the danger signal behind it, which would be mechanically released only when the train had left the block; also to the working of switches. The interlocking feature appears to be positive.

S. D. LEE.

Rochester, N. Y.

FOR what is the greatest amount of lumber used? Nine people out of ten will say for houses and buildings. It is doubtful if 35 per cent of the lumber output goes into buildings. The railroads, farmers, and miscellaneous purposes take about 40 per cent, and the other 20 per cent goes into boxes. The estimate is made, says the *Southern Lumberman*, on the judgment of some of the oldest and best informed lumbermen in the country.

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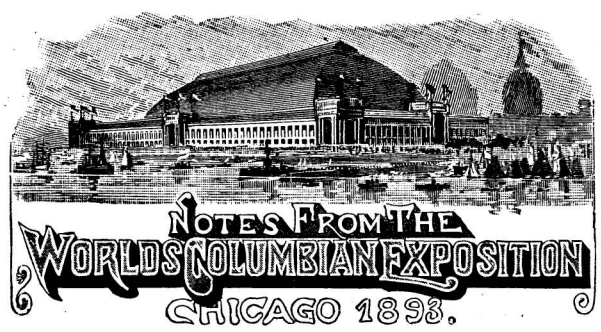


Marine Exhibits in the Palace of Transportation.—Entering the Transportation Palace by the "Golden Door," the first object that attracts attention is a large model of the Santa Maria, the arrival of which on our shores in 1492 is being celebrated by this great Fair. The larger reproduction of Columbus' vessel that sailed across the ocean to take part in the celebration is moored in the South Inlet, near the Convent of La Rabida, where crowds of people visit her daily. We have already published a cut of this quaint structure and the vessel.

Just beyond this model is Grace Darling's boat, in which she rescued so many shipwrecked people. Turning from this exhibit, so suggestive of admiration of courage and thankfulness for lives saved, we come upon one that prompts only sorrowful thoughts. We refer to a large model of the Victoria, which was so needlessly wrecked, carrying down with her many brave men. The sad catastrophe made this model doubly interesting, and it was constantly surrounded by visitors, many of whom expressed sympathy for the families of those who were lost. The model is perfect in every detail, even to the screen for protecting the hull from torpedoes, and a little placard marks the spot where the vessel was struck by the Camperdown. Armstrong, Mitchell & Co., of Newcastle-on-Tyne, are the owners of this and many other interesting models, among which is one of the Spanish cruiser Reina Regente, one of the vessels sent to participate in the naval review at New York last spring. The active part taken by English and Scotch firms in the construction of the navies of the world is demonstrated by the numerous models of war vessels belonging to different nations, contained in the British section.

An excellent opportunity is also offered for the study of the evolution of the transatlantic steamer. The Cunard Line, for instance, shows models of many of its vessels, beginning with its pioneer side wheeler, Britannia, which was built in 1840, and was probably considered a marvel at that time, for it was 207 feet long, its gross tonnage is 2,050, and its engines developed 403 horse power. These figures seem very small when compared with the dimensions of the beautiful new twin screw propellers the Campania and the Lucania, which have been completed this year and are now making such fine records in actual service. The length of these vessels is 620 feet, their displacement 18,000 tons, and their horse power 30,000.

The German section contains other interesting models of transatlantic steamers, among which are those of the Kaiser Wilhelm (length 449 feet, tonnage 3,675, horse power 6,400), of the North German Lloyds Line, and the Furst Bismarck (length 502 feet, horse power 14,000) and the Augusta Victoria, of the Hamburg-American Packet Company. The names of these steamers are so familiar that it seems like being among old friends when we are surrounded by the models.

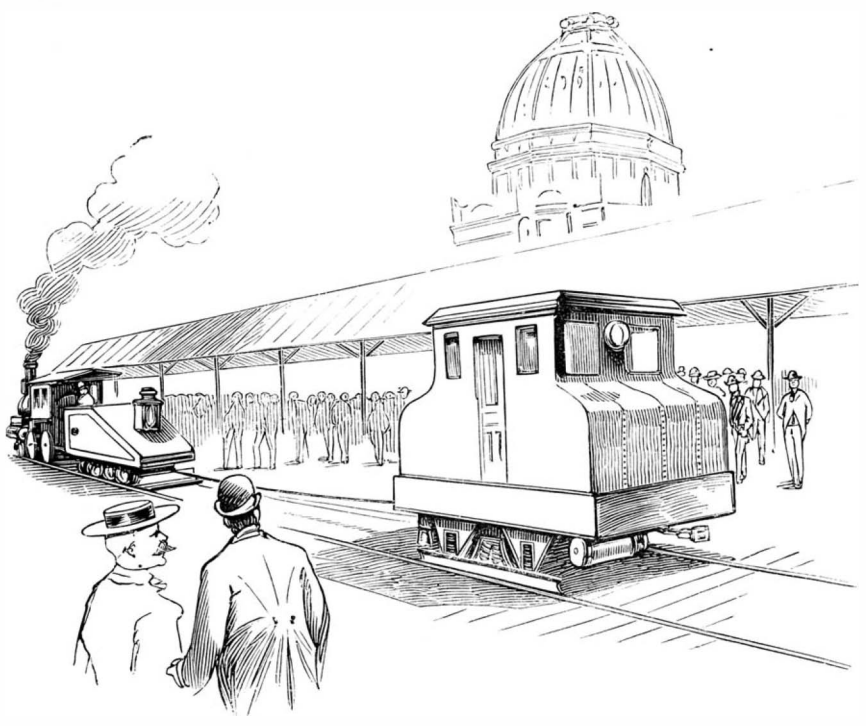
Messrs. Laird Bros., of Birkenhead, England, had an interesting exhibit consisting of a long glass case filled with tiny models of vessels made by them, and so arranged as to give a chronological record of different types from 1830 to the present time.

An exhibit which is very interesting in a different way is that of Thomas Cook & Son, of London, the firm whose name is so well known to tourists in all parts of the world. They exhibit models illustrative of modes of travel used at different periods, the oldest being models of funeral boats, each containing several figures, that were found in tombs in Egypt. Some of these are said to be 4,000 years old. There are also models of Venetian gondolas and of modern excursion steamers used on the Nile. It is interesting to note the difference between them and the vessels generally used for the same purpose in this country. They are fitted to accommodate from 10 to 78 saloon passengers. They are appropriately named for ancient Egyptian rulers and gods, one being called Rameses the Great and another Hathor. But the most striking object in this pavilion is a fine model of the Temple of Edfou, which is perfect in every detail. Interest in this model is enhanced by the explanations of its various courts and passages given, in perfect English, by a real Egyptian. After Mohammed had finished his little lecture he produced coins, both ancient and modern, from pockets hidden in different parts of his voluminous garments (the concealed pockets of the "Heathen Chinee" are not worthy of mention with those of Mohammed), which he is very ready to exchange for United States coin, in spite of the uncertainty of the fate of the Sherman bill. He vouched for the authenticity of the ancient coins by saying that he was from Luxor himself and knew the excavations well; in fact, he gave us to understand that he was the best guide of the Nile country, to which he expects to return after the close of the Exposition.

Not far from this pavilion is a model of the yacht Livadia, built for the Czar of Russia, which, when afloat, must be a very odd-looking craft, for it is so broad as to give the impression of being round. Its bottom is flat and is provided with three ridges, that seem to be equivalent to three keels, one in the middle and one on each side. It has three screws and three smoke stacks, the latter being arranged side by side instead of one in front of the other.

A visit to the Japanese section shows that this little country is doing her best to keep abreast of the rest of the world in the construction of war vessels as well as in other branches of industry.

In the Brazilian section there is an odd boat built of logs, bound together after the fashion of a raft, but the logs are sharpened at the ends so as to give some shape to the bow and stern. On this is built a little hut with a thatched roof. It carries a good sized sail, and for a rudder there is only a paddle. Near it is a dugout that is capable of carrying over 4,500 lb. of sugar and twelve or more passengers. It can be rowed or sailed, and in either case is managed by one man.



STEAM LOCOMOTIVE VS. ELECTRICAL LOCOMOTIVE—A TUG OF WAR.

Although it seems as if there were models enough on the main floor to represent every variety of vessel that was ever made, there are still more in the gallery; besides full sized Indian canoes and dugouts, modern sculling skiffs, and beautiful gondolas. The latter are very richly finished, although they are, of course, entirely black, this being required by the law that was passed to prevent the ostentatious display that formerly produced such a contrast between the gondolas of the rich and the poor. In the gallery there are many little toy-like models of devices used in Asia and Africa. One of the crudest of these resembles an immense gourd across which the boatman, if the term may be allowed, throws himself face downward, his arms extending beyond it so that he can propel himself by means of a paddle which he holds in his hand.

These are a few of the exhibits contained in the great Transportation building, a thorough examination of which would require days.

Some State Exhibits of Minerals.—In the Palace of Mining in the center of the main aisle is a shaft of anthracite coal fifty-four feet high, representing a columnar section of the mammoth coal vein in the mines of the Lehigh Valley Coal Company, and near it is a monument of cubes, each block illustrating a product of the mines of the United States for one second of time as estimated from the records of the United States Geological Survey. The base of the monument is bituminous coal. Then come anthracite coal, limestone, natural gas in its coal equivalent, petroleum, iron ore, granite, salt, and so on, descending down the list until precious stones are reached, this cube being very minute. The Pennsylvania exhibit is particularly complete in its display of coal, both anthracite and bituminous, and petroleum. The West Virginia exhibit contains a fine display of bituminous and semi-bituminous coal, coke, iron ores, building stones, petroleum, both crude and manufactured products, and salt.

In the New York exhibit is an obelisk made up of the geological formations occurring in this State from the Archæan to the Trias, the four sides of the obelisk representing the four points of the compass, showing the occurrences of the several formations in the respective quarters of the State. The exhibit comprises petroleum, magnetite, red and brown hematites and other iron ores, paint minerals, a complete line of building stones, lime, cement, commercial clays and clay manufactures, salt and mineral waters.

The facade of the Kentucky section is an arch of cannel coal, while the floor of the entire section is covered with tiles manufactured in this State. The exhibit comprises chiefly clays, fire and other bricks, terra cotta and other manufactures of clay, building stones, coke, coal from several veins, and many specimens of iron ores.

The facade of the Ohio exhibit is built of brick and sandstone, carrying a large display of glass, cements and clays. The floor of the section is covered with artistic tiles manufactured in Ohio. The conspicuous feature of this exhibit is a miniature salt plant, showing how salt is evaporated, dried, ground and packed. Another particularly attractive exhibit is a reproduction in miniature of a Lima oil well from which crude petroleum is pumped. Ohio also shows some fine samples of iron ore, pig iron and coal. One large block of coal, weighing fourteen tons, shows a section of a vein in the Hocking Valley which is 15 feet 3 inches in thickness.

Indiana's display is mostly of bituminous coal. There are also samples of coal dust worked up into balls the size of an egg by the use of agglutinizing substances. Petroleum, both crude and refined, commercial clays, building materials, ornamental and fireproofing terra cotta, and cannel coal complete the exhibit.

In the Michigan exhibit a large share of the space is devoted to the iron and copper mining industries of this State. There are immense blocks of native copper and piles of ingot copper, copper bars and cakes, reels of copper wire and rolls of sheet copper, while in one of the cases are shown many copper tools, relics of aboriginal copper workers.

The Cleveland Cliffs Iron Company exhibits a model of a cross section of the Cliffs' shaft mine, constructed on a scale of a quarter of an inch to the foot. The surface of this model is covered with the actual material represented, which has been granulated and cemented in place. The various shafts and levels are shown, and the method of timbering.

The Iowa State exhibit presents the "Black Diamond Hollow," representing a section of a coal mine level, with a miner at work with his pick upon the seam, with lumps of coal scattered about and the mine car in the foreground, nearly loaded with blocks of coal. All the tools used in coal mining are shown. There is a grotto filled with fine specimens of crystalline formations from caves in various parts of Iowa.

Several propositions have been made looking toward keeping the Exposition open later than October 30, but it is doubtful if such a venture will be entirely satisfactory to visitors, as many exhibitors are determined to pack up and get away immediately after the legal time of closing, which is October 30. The buildings themselves are anticipating the closing day, as the plastering is cracking off in places and the staff work is generally stained and in some places broken; not enough as yet, however, to seriously affect the appearance of the buildings. The foundations of some of the buildings have settled considerably. This is especially true of the Horticultural building.

Saturday, September 16, was Railroad day, and an interesting programme was prepared to entertain the public, but nothing seemed of so much consequence to the public as the "tug of war" between a steam locomotive and an electric locomotive.

The steam locomotive was No. 10, that has been in service on the Baltimore and Ohio Railroad for some fifteen years. It has 16×24 cylinders, uses steam at 140 pounds pressure, and weighs on the drivers about 35 tons, while the tender gives an additional weight of about eight tons. The electric locomotive is one recently built by the General Electric Company and has thirty tons on the wheels. Its motor capacity is 250 horse power. This locomotive was designed to operate on an overhead trolley, but as none was at hand, temporary cables connected the motors to the Exposition 500 volt circuit. The steam locomotive easily drew the electric locomotive all over the track. The two engines were fastened together by a heavy

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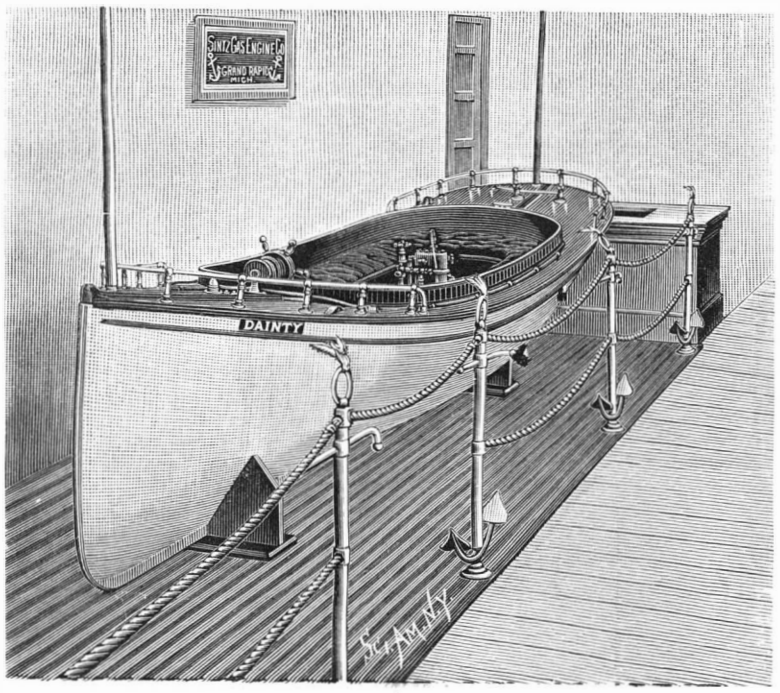
wire cable twenty feet long. We give a rough sketch of the contest; the electric locomotive is at the right, the steam locomotive at the left.

The Columbus caravels have been officially turned over to the United States government by representatives of Spain and have been formally accepted. They have been towed into the South Canal beyond the reach of possible damage by the waves of Lake Michigan and will remain there until the Exposition closes. The Spanish sailors who have been in charge have returned to Spain, and sailors from the United States navy are now on board.



THE WORLD'S COLUMBIAN EXPOSITION—THE SINTZ GAS ENGINE COMPANY'S EXHIBIT.

FINE WATCH TOOLS AND MACHINERY.

The exhibit at the World's Fair of the Faneuil Watch Tool Co., illustrated herewith, occupies a space of 15 × 20 ft. in Machinery Hall annex, and is shown in two cases of ebony and plate glass which present a fine appearance. The principal feature of the exhibit is the No. 4 Rivett bench lathe, which has a swing of 8 in., length of bed 36 in. and a distance between the centers of 18 in. Four of these lathes are shown. This lathe is used by first-class tool makers and in building fine machinery, and the great feature of the lathe is the many valuable patent attachments. The lathe can be converted into a milling machine in a minute's time, and the quill and the headstock both take the same size chuck. The case contains fifty different shaped cutters—round, oval, and all kinds of irregular shapes made on this machine. The lathes are arranged in the case to show the different attachments in position for work. One shows the patent slide rest, the rigidity of the tool holder of which makes this tool so valuable, another lathe shows the turret attachment, a third the milling attachment, and a fourth the grinding attachment.

With this lathe is used the self-centering split chucks, a set of which comprises all the sizes from $\frac{1}{32}$ in. to $\frac{1}{2}$ in. by 64ths. Two of the No. 3 lathes are shown, of which may be said all that has been said of the No. 4, except in regard to its capacity, which is smaller than the No. 4. Thirteen of the watch maker's lathes are shown, each arranged to show some different attachment in position for work.

The Rivett lathes, as is well known, stand in the front rank of appliances for executing all kinds of fine, nice work, being especially adapted to satisfy the wants of fine tool makers, model makers, electricians and watch tool makers. An illustrated catalogue, which will be sent on application, shows the lathe with its different attachments and a variety of samples of the work done therewith. The office of the company is at No. 474 Washington Street, Boston.

A GAS ENGINE EXHIBIT AT THE FAIR.

The exhibit at the World's Columbian Exposition of the Sintz Gas Engine Company, of Grand Rapids, Mich., comprising a small boat with a special adaptation therefor of their well known gas and gasoline engines, attracts not a little attention. Their marine engine, shown in a separate view, is the same as the stationary engine made by the firm, except that it has but one small flywheel and has a different base, to suit the foundation in boat. It also has an attachment for changing speed of engine while running. The propeller wheel is of a new design, and in smaller sizes has only two blades. The blades are reversible, and the wheel can be made a right or left hand screw while the boat is running, the pitch of the blades being regulated as desired. The engine makes its own gas from gasoline, as it is used, no boiler, coal, wood, or water being required, except the small amount of water in the jacket of the outside cylinder. The explosive charge is ignited from a small electric battery, obviating the possibility of accidental explosion of the gasoline, and it is said that the expense of running the engine does not exceed the cost of three-fourths of a pint of common gasoline per hour for each horse power. The engine has all the necessary appliances for working automatically, the governor regulating the charge of oil or gas, and thus controlling the speed.

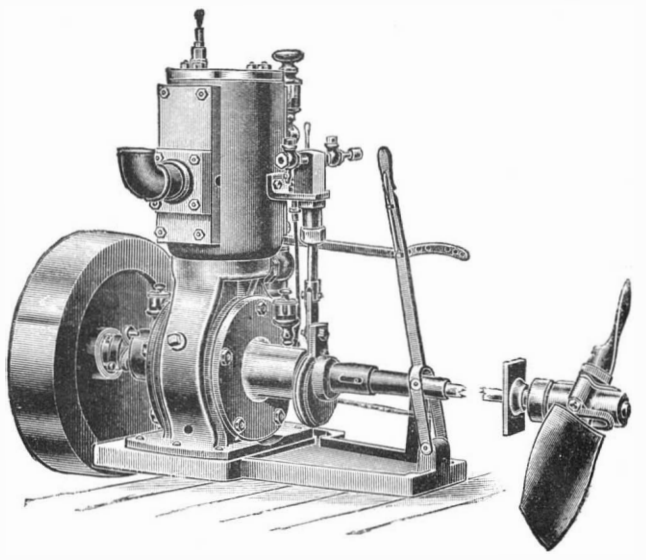
Compression of Steel Ingots by Centrifugal Force.

At the Nykroppa Iron Works, in Sweden, a method of consolidating steel ingots, by subjecting the freshly filled mould to pressure developed by centrifugal action, has been introduced by the manager, Mr. L. Sebenius.

The apparatus consists of an upright shaft in the center of a cylindrical casting pit, carrying a frame of four arms, to each of which is articulated a platform supporting four ingot moulds. While the shaft is at rest the moulds are upright, and are filled in the usual way; but when it is set in rapid rotation they fly up into the horizontal position, and a pressure in the direction of the length of the ingot is developed equal to thirty times that due to the column of liquid metal in the mould, which drives the gases out, and produces a perfect solid casting. Uniformity of composition is also induced, as, on account of the rapid cooling, liquation is prevented. The process, which has now been in use about two years, has been applied to both the Bessemer converter and to the open-hearth furnace. The ingots are free from external defects, and the loss by defective ends has been diminished 40 per cent, the metal being so compact as to bear rolling to finished sizes without the use of the cogging mill. The cost of the apparatus is about £400 for a three-ton charge and £800 for a ten-ton charge.

The circumference described by the bottom of the moulds, when spun up into the horizontal position, is about 67 feet, corresponding to the working speed adopted of 125 revolutions, to a velocity of nearly 10,000 feet per minute. The pressure on the mould, taken at thirty times the pressure on the ingots, will be about 150 feet of iron, or from 500 pounds to 600 pounds per square inch. In the form of the apparatus intended for smaller ingots, the moulds are arranged in an inclined position, and radially to a central fixed vertical feeding tube upon a turntable, which is set in rotation after filling, or the latter operation may be performed while the table is actually in motion.

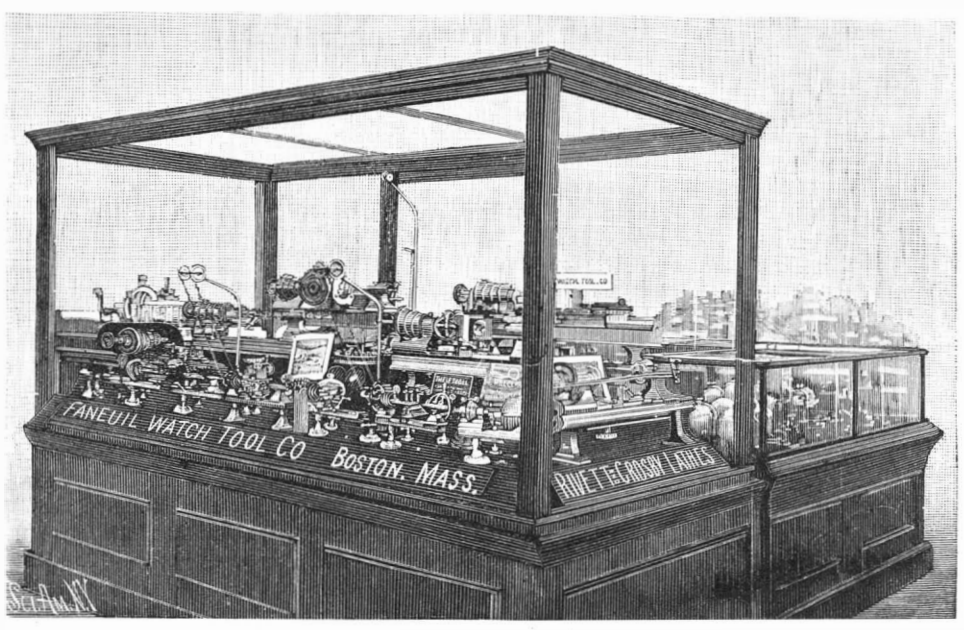
There is a modification of the apparatus, in which the rotating table, being smaller in diameter than that previously adopted, can be driven at a higher speed, up to 200 revolutions per minute. There are eight pivoted moulds, each divided by internal walls, so as to give nine small ingots, suitable for wire billets or thin sheets. By means of a central annular funnel, lined with refractory material, and provided with eight feeding spouts, or one for each group of moulds, the whole number of 72 ingots are cast by a single pouring from the ladle, which contains from four to six tons of steel.



THE SINTZ MARINE ENGINE.

Difficulties of Railway Development in China.

A curious example of the difficulties of railway construction in China is afforded by the conduct of the Tartar general of Moukden, the capital of Manchuria, in connection with the surveying work for the railway from Kirin, another large Manchurian town, to Newchwang, the seaport of the province. It was proposed to make a junction on this line for Moukden at a place called Lanpien, a short distance outside the city; but the general got a number of geomancers to investigate the effect of this selection upon Moukden. These sages reported that the vertebræ of the dragon which encircles the holy city of Moukden would be broken by driving the long nails of the railway sleepers into them, and accordingly the general vetoed the decision of the engineers, and directed them to carry the railway in a straight line from Kirin to Newchwang without approaching Moukden at all. This was, no doubt, much shorter; but the engineers objected that the country which the line would cross by this route was a low and marshy tract of land, liable to floods during the wet season, and also that it was sparsely populated, so that no traffic would be got. By the route which had been decided upon, the line, though longer, would pass through thickly populated country and on high and level ground. The engineers reported the matter to Li Hung Chang, who wrote commending the Tartar general for his anxiety for the geomantic influences of the ancestral home of the reigning dynasty, but adding, as his candid opinion, that these influences would be improved by the junction rather than otherwise. However, the viceroy said, as the general had vetoed the decision of the engineers, the matter must be laid before the Emperor and the works stopped until his Majesty's decision was known. This seriously alarmed the general, who promptly wrote asking that the works should go on, and in the meantime he would think about it. A place a few hundred yards from the former site was chosen, and the geomancers declared that this would not affect the dragon's pulse, whereupon the general wrote to the viceroy that he was now satisfied, and that he trusted no report would be made to the Emperor of the delay.



THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF THE FANEUIL WATCH TOOL CO.

Origin of Atmospheric Oxygen.

Dr. T. L. Phipson, who has devoted a considerable amount of attention to problems concerning the constitution of the atmosphere, is led to the conclusion that the original atmosphere of the globe consisted of nitrogen alone, and that the oxygen now present is the product of vegetable life. In a paper in the *Chemical News* he states that minute microscopic plants (*Protococcus pluvialis* and *P. palustris*) can be easily transformed into manufacturers of oxygen gas. As the result of experiments, some of which we recently referred to (see *ante*, p. 83), he concludes that plants absorb carbonic acid by the roots and secrete oxygen by the leaves, from which it is subsequently given off. Into the primitive atmosphere of nitrogen, the early vegetation would thus pour oxygen during countless years until its composition became practically what it now is.

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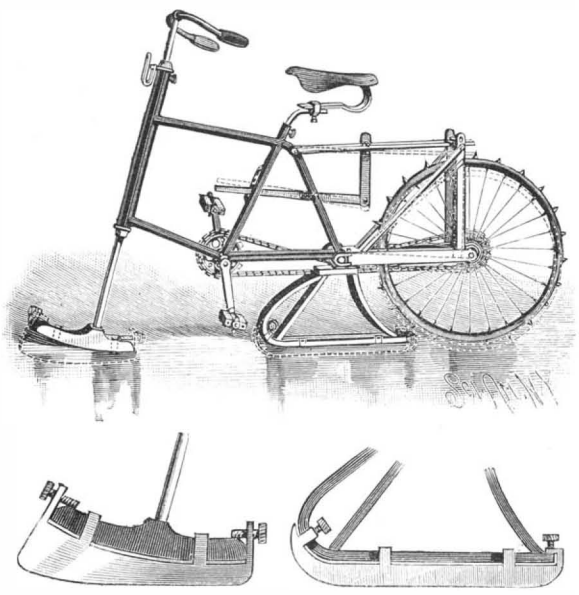
A SNOW AND ICE VELOCIPEDE.

A machine resembling an ordinary safety bicycle, and driven in the same way, but which is adapted for use on either snow or ice, is shown in the engraving and has been patented by Mr. Jonas Schmid, of No. 607 East Sixth Street, Erie, Pa. The frame is preferably tubular, for the sake of lightness, and its rear end terminates in an axle on which are pivoted bearing blocks secured to the top of a runner aligning with the

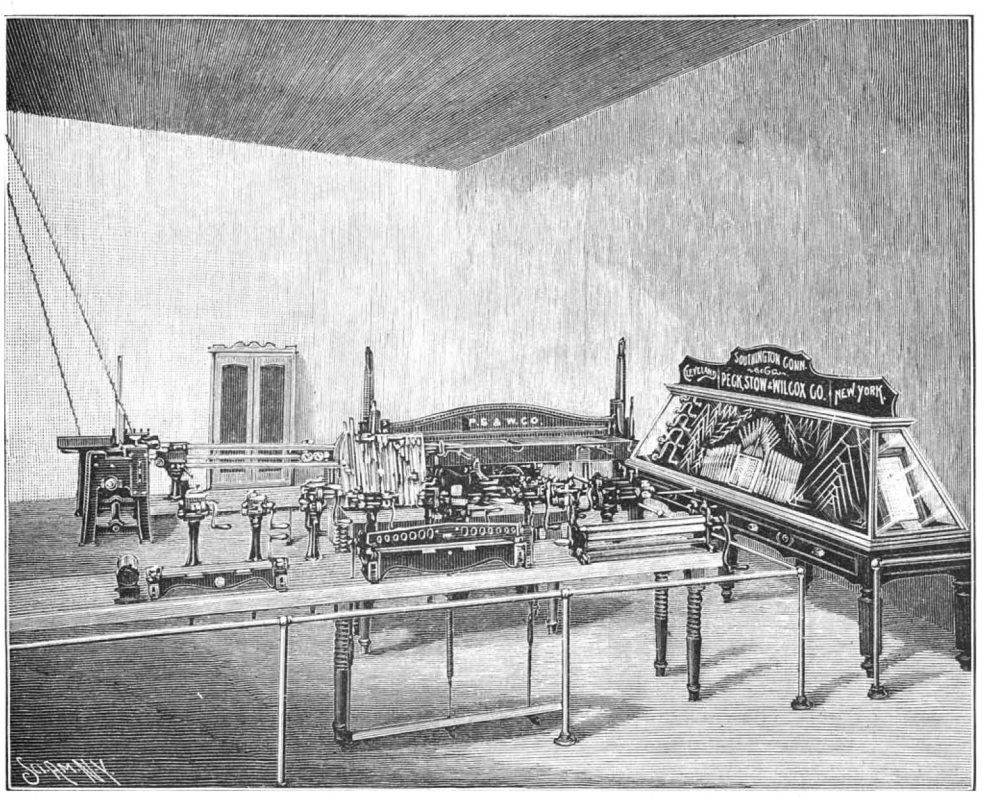


SCHMID'S SNOW AND ICE VELOCIPEDE.

driving wheel. On the front end of the frame, in a ball bearing, is a sleeve through which extends the steering post, at the lower end of which is a curved runner, its shape enabling it to be easily turned in steering. The driving wheel has a thin steel rim with projecting teeth to get a good grip in the snow or ice, and is driven by a sprocket chain from the crank shaft. Extending upward from both members of the fork in which the wheel is journaled, are posts connected by a stiff flat spring with the frame, the spring being clasped near its center by pins on a depending link pivoted to a lever fulcrumed on the back part of the frame, at a point lower down, the forward end of this lever being held at the desired height by a rack bar, whereby the spring is raised or lowered to tilt the frame of the driving wheel and thus regulate the height of the wheel in relation to the rest of the machine. The saddle is carried by an arrangement similar to that in use on the ordinary safety bicycle. When the machine is to be used on ice, skates, as shown at the bottom of the picture, are attached to the front and rear runners, the skates being held in firm position upon the runners by lugs, flanges and thumb screws, while the construction admits of their ready attachment or removal. The machine may be very easily and rapidly driven and perfectly controlled.

A WORLD'S FAIR EXHIBIT OF TINNERS' TOOLS, MACHINERY, ETC.

The display of tinsmiths' tools and machines in the exhibit of the Peck, Stow & Wilcox Co., in Machinery Hall, contains a large variety of goods of the highest grade of excellence, the most of which have long had an enviable reputation, not only in the United States, but in many foreign markets. Prominently shown in the exhibit is a large eight-foot squaring machine and a hemming or binding machine for making map binders. The firm make a large line of shears, up to heavy power shears for cutting or shearing heavy metal, and including shears having irregular shaped blades for cutting any desired shape, such as elbow sections, corset steels, saw blades, etc., these blades to be used with either foot or power shears. Other shears are especially adapted for cutting corrugated metal, the blades fitting the corrugation and blades of different sizes fitting the same shears, these shears being especially desirable for cornice makers, roofers, etc. These shears all have the most recent improvements, are made of the best material and show first-class workmanship throughout. Hand shears, nippers, punches, chisels, grooving tools, tinners' stakes, hammers, roofing tongs, seamers, soldering coppers and numberless other tools contribute to make a display which for extent and variety has few equals. The firm also make a large line of house furnishing goods, and their name stamped upon an article is in every case a guarantee of its sterling worth. Their main store and office is at No. 27 Chambers Street, New York City.



THE WORLD'S COLUMBIAN EXPOSITION—THE PECK, STOW & WILCOX CO.'S EXHIBIT.

Steam Cuts Metals.

M. Daubree points out that leakage from steam pipes may cut through metal plates. He cites an example in which metal exposed to the escaping vapor from a steam pipe at a pressure of seven atmospheres, 105 pounds, was found to be channeled and striated; the marks being similar to those made by a saw or a file. A valve on a steam pipe and the seating of a safety valve may be attacked in the same way. All groovings in metal attributable to this cause are polished as if by emery. This observation points to the remarkable conclusion that, given sufficiently high pressure and rapid motion, gaseous bodies can polish and striate in a way generally supposed to be confined to the action of solid bodies. This, indeed, is in conformity with the general results of advanced physical research, which show that under sufficient pressure, hard and solid bodies can be made to act as liquids; while soft and even gaseous bodies, if endowed with sufficient force and speed, act like solids.

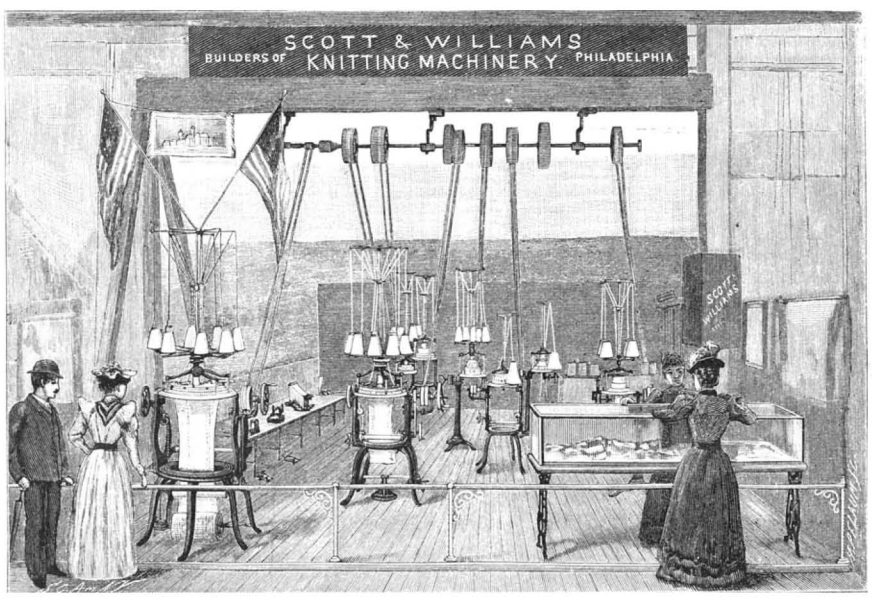
Inventor of the Screw Propeller.

In referring to the recent celebration in Austria on the centenary of the birth of Joseph Ressel, inventor of the screw propeller, who died in poverty and neglect in an inn at Laibach in 1857, the *Shipping World*, of London, says:

"His claim to priority in the invention of the screw propeller was disputed in England and elsewhere, but seems now to be well established, the various documentary proofs having just been published, together with invectives against his 'stupid countrymen' and the 'heartless foreigner who snatched the honor and the glory from him, to whom both were legitimately due.' Ressel described his idea of using the Archimedean screw for the propulsion of ships as early as 1812. It was not until 1829, when his former patents had all lapsed for want of money to renew them, that he succeeded in interesting a Trieste merchant, named Fontana, in his invention. A small steamer, the Cidetta, fitted with the first screw, left Trieste harbor in that year, and proved manageable in every respect for the first five minutes, when, unfortunately, one of the pipes burst. This was enough for the Trieste authorities to forbid any further experiments of the kind, and the inventor had to continue as an employe of the forestry department of the government on a salary of £70 a year. That his great achievement should have been unrecognized and unrewarded during his lifetime is, perhaps, the best of all reasons why the present opportunity should be taken to do honer to his name, and to perpetuate his memory in an effective manner."

KNITTING MACHINES OPERATED BY ELECTRICITY AT THE FAIR.

One of the most attractive displays of the Exposition, to any one having even but a slight acquaintance with the extent and variety of the textile industries of this country, is that of Messrs. Scott & Williams, builders of knitting machinery, whose main office and works are at No. 2079 East Cumberland Street, Philadelphia. The exhibit is in section 29 Machinery Hall, where a complete outfit of their machines for making knitted fabrics is shown, all in full operation, run by electric power. Here may be seen a rib border machine making rib tails, drawer bottoms and cuffs; a ribbed underwear machine making ladies' plain or shaped rib vests, with plain or royal rib stitch—the machine being also used for making union suits; a two-feed sleever for making long or short sleeves, or rib tops for half hose; a single-feed welter which makes tops for half hose and legs for hose with welt and slack course, etc. An automatic splicing attachment for the last mentioned machine reenforces the knees of long hose by automatically knitting in an extra or re-enforcing thread half way round the stocking. There is a fancy ribber for making fancy stitch for hosiery, caps, or any similar class



THE WORLD'S COLUMBIAN EXPOSITION—SCOTT & WILLIAMS' EXHIBIT OF KNITTING MACHINERY.

of work, and an ingenious bar stitch or pillar bar machine for finishing the edges of ladies' vests and children's underwear. A delicate silk ribbon is fed to and automatically inserted into the bar stitch finish made on the machine and attached to the garment. This machine is used for attaching any variety or form of lace or edging, and inserting a ribbon at the same time. A chain machine makes eleven strands or chains for use on this bar stitch machine, the chain being crocheted or looped by an ingenious mechanism from yarn or thread. There is also a machine styled the looper, for closing the toes of stockings previously knitted on another machine. The exhibit receives the marked attention of practical men in the business, and is acknowledged to be one of the most complete and meritorious of the displays illustrative of the textile manufacture.

The Age of Maturity.

Statistics are said to show that young men do not, on the average, attain full physical maturity until they arrive at the age of twenty-eight years. Professor Scheiller, of Harvard, asserts, as the result of his observations, that young men do not attain the full measure of their mental faculties before twenty-five years of age. A shrewd observer has said that "most men are boys until they are thirty, and little boys until they are twenty-five," and this accords with the standard of manhood which was fixed at thirty among the ancient Hebrews and other races.

THE costliest mile of railroad is a mile measured on the steel portion of the Forth bridge. The length of this portion is a mile and twenty yards, and the cost of it was considerably over $10,000,000. The most expensive railway system in the world is the "Inner Circle" line of London, which cost, including the purchase of land, from $3,000,000 to $5,000,000 per mile. The last constructed mile, between the Mansion House and Aldgate, cost altogether, including "compensations," nearly $10,000,000.

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Tests of Holtzer Shot.

The initial test of Holtzer armor-piercing shot manufactured in the United States was made September 5 at Sandy Hook proving grounds. Two of the projectiles were fired at 9 inch armor plates. The Holtzer shot is the invention of M. Edouard O. Brustlin and the name Holtzer is derived from the name of the makers. The Midvale Steel Company, of Philadelphia, have obtained the exclusive right to manufacture the new projectile in the two Americas. The projectiles tested were 8 inches in diameter, 28·2 inches long, and weighed 300 pounds. The shot was fired from an 8 inch sea coast defense rifle, the armor plate being a nickel, oil tempered, and annealed steel plate, 8 feet 4 inches long and 6 feet wide. The plate was made by the Bethlehem Company. The approved charge was 100 pounds of brown prismatic powder, as this was found to produce the required velocity of 1,625 feet a second.

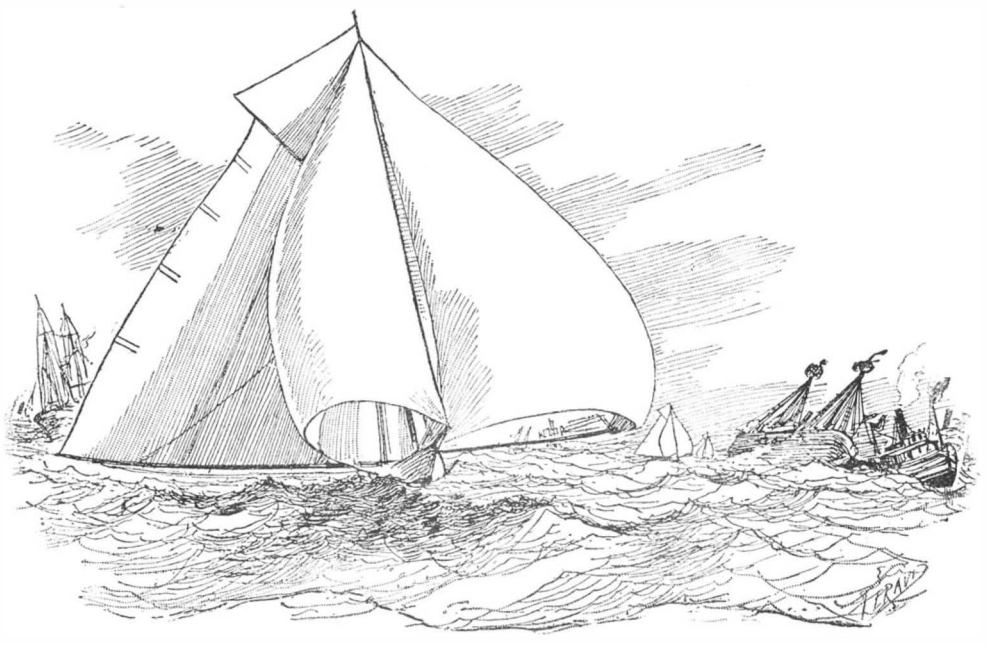
The first shot fired passed through the 9 inches of steel, 36 inches of oaken backing, and buried itself in the sand. The perforation in the plate somewhat resembled that made by an auger. Owing to the strain, some of the edges curled upward and outward and showed a blue tinge, which denoted that the force of impact had heated the plate to 600° F. There were no cracks radiating from the perforation, and the plate was regarded by the officers in charge as highly successful. The second shot developed the same chamber pressure as the first, 23,460 pounds to the inch, and the penetration was equally good. The workman found the second shot, and when measured it only showed a difference of five-thousandths of an inch in diameter and two-thousandths of an inch shorter. The sharp point was not blunted, and the shot could almost have been fired again if the rifling band of copper had not been injured. The test was considered highly successful, and a third shot was not fired. A series of lots of 8 and 10 inch shot will be submitted later on.

THE VIGILANT TO CONTEST THE INTERNATIONAL YACHT RACE.

The yacht selected to defend the America's cup against Lord Dunraven's Valkyrie is shown in the illustration as she appeared when crossing the line at the close of the last of the trial races, September 11. The Vigilant is of the deep centerboard type, and was built at Bristol, R. I., by the Herreshoffs. Her length over all is 124 feet, water line 86·12 feet, beam 26 feet, and draught 14 feet. Her displacement is about 140 tons. While her framework is of steel, the plating on her from the sheer strake down is of Tobin bronze. The rivets are also of bronze. Her bottom is, therefore, very smooth. The surface is kept free from barnacles and weeds, and is capable of acquiring a very high polish. The Vigilant is widest at the deck. On the ways she appears to be a boat with a great depth of keel, an easy bilge, a shoal body and a small displacement considering her dimensions She has an immense spread of canvas. According to the official measurement, her boom was 100 feet long; gaff, 54·76 feet; mast to jib stay, 74·85 feet; mast to jib topsail stay, 75·90 feet; length of spinnaker boom, 74·62 feet; perpendicular hoist for determining sail area, 122·28 feet; length of topmast, 56·88 feet.

The British yacht Valkyrie, which is to sail against the Vigilant, arrived at New York September 22, after the rather long voyage of thirty days from Southampton, England. The Valkyrie was designed by Mr. G. L. Watson.

She has a long, well shaped body, and looks to be a thorough racer. Her construction shows a radical departure from all English precedents. Her spar and sail plan are unlike anything before attempted by English designers. Her estimated dimensions are: Length over all, 126 feet; water line length, 85 feet; beam, 22 feet 6 inches; draught, 15 feet 6 inches; boom, 90 feet. Her bowsprit is only 16 feet long. Her mast is stepped well forward. In her races on the other side the Valkyrie has shown up better in light airs. She is strong to windward and fast on a reach. The harder it blows, the better she seems to like it. It is expected that the race will come off October 5, the course being at the entrance to New York Harbor. The contention is for the famous prize cup won by the yacht America, in a contest with a fleet of British yachts, off Cowes, England, in 1851, and which has since remained as a standing challenge for British yachtsmen, the latter having never yet been able to win it back, although they have earnestly striven to do so in many spirited races, which have been fully illustrated and described in the SCIENTIFIC AMERICAN.

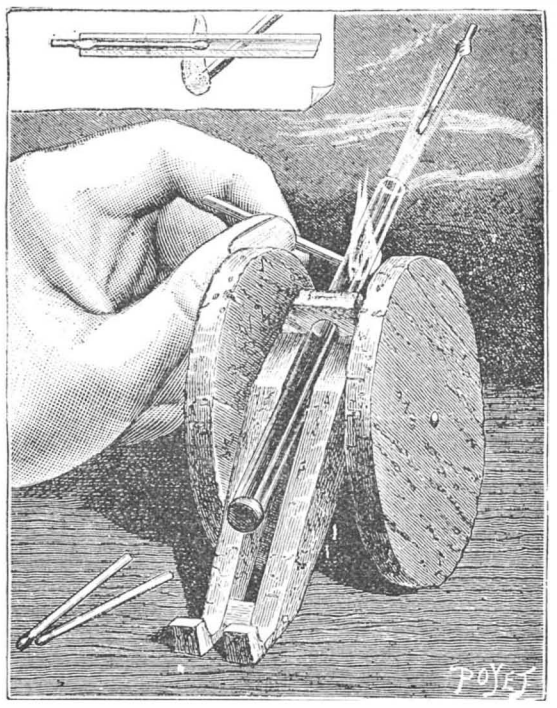


THE YACHT VIGILANT "CROSSING THE LINE," WINNER OF THE TRIAL RACES.

A TOY CANNON.

Let us take a glass tube three millimeters in diameter and about ten centimeters in length, and let us close one of its extremities with a little sealing wax. This will constitute our cannon.

On another hand, let us cut out from a sheet of cork a piece two centimeters square in which we shall form an aperture through which will pass our glass tube, the open extremity in front. Let us fasten this piece by means of pins to the extremity of two strips of cork cut into the shape of stocks, cheeks, and trail. Finally, by means of pins let us fix to the sides of the front square piece of cork two disks cut out of cardboard or



TOY CANNON.

sheet cork. Here we have our gun mounted upon its carriage. It now remains for us to procure the priming, load, wadding, and projectile. This will not take long, for we shall find the whole united in an object easily obtained, viz., a simple wax match. It is necessary to select wax matches with a blue extremity, which snap through friction, on account of the presence of a small quantity of chlorate of potash in the phosphorus paste.

Pinch the match between the thumb and forefinger of each hand, very near the end opposite the head, and break it in all directions, so as to cause the stearine to fall from the part between the fingers and expose the wick. Then bend toward each other the small and large ends that remain rigid, and expand the uncovered portion of the match and form a sort of tampion of it, as shown in the upper portion of the figure. The match being thus prepared, introduce it head first into the glass tube, and drive it in until the expanded portion of the wick forming a tampion closes the mouth of the tube. The closing should not be absolutely hermetical.

The gun is now loaded and ready to be fired. In order to effect the firing, place the flame of another match under the glass tube, heating more especially the portion in which the head of the match is located in the gun. Quite a strong detonation will at once be heard and the projectile will be seen flying in the midst of a light cloud of blue smoke. This projectile is represented by the wick of the match, which, after describing its trajectory, falls, at a distance of from five to six meters from the cannon, upon the floor, where it should be received upon a piece of paper as a precaution against spots.

Care should be taken to fix the wheels upon a visiting card by means of pins in order to prevent a recoil, which, moreover, will be manifested by a backward sliding of the glass tube in the piece of cork that serves it as a support.

Despite its frail appearance, this little gun is capable of firing a hundred shots without being put out of service. In case the chamber becomes foul, it may, when cool, be cleaned out with the little device used by smokers for their pipes.—*La Nature.*

Welding Rail Joints by Electricity.

In the course of a paper read before the American Street Railway Association, Mr. A. J. Moxham gave the results of experiments made at Johnstown, Pa., in the electric welding of very long rails. These experiments were carried out with rails jointed solidly and held by heavy fishplates, and they demonstrated that for street rails buried in the ground expansion could be neglected. Subsequently 3,000 ft. of line was welded solid, and although the track has been subject to a range of temperature of 30 deg., no linear or lateral motion has been observed. This line was laid in May, and the welds were made with a specially designed Thomson welder. Now, as mentioned in a previous issue, 16 miles of track at Cambridge are being welded. The track has been in constant use for two years, and the welding is being done without disturbing the track or paving, except to remove a few paving blocks at the rail joint. The rail is a heavy girder rail about 8 in. deep. The old fishplates are first removed, and the ends of the rails freed from rust and scale by a hand emery wheel on a flexible shaft and operated by an electric motor. A thin piece of steel of the same shape as the rail section is driven tightly between the rail ends to insure contact. Then the joint is ready for welding. The current necessary to the operation of the car and plant is taken from the trolley wire over the track. This current is employed directly to propel the car, to operate the derrick by which the welding machine is moved, to run the emery wheels before mentioned, and to actuate a large dynamotor inside the car. This machine takes the 500 volt direct current of the trolley wire and converts it into an alternating current of 300 volts potential. This alternating current is in turn conducted into a transformer, which reconverts it into a current estimated at four volts and 40,000 amperes. This current is then conducted from the transformer though 1,000 strips of copper to the secondary poles, and through the fishplates and the web of the rail. The forcing of this great current through the plates and rail causes heating sufficient to produce a white welding heat in two or three minutes. The poles in contact with the white-hot fishplates are kept cool by a jacketing of water circulated through pipes. When a welding heat is obtained the pressure is applied by a few revolutions of a hand wheel, and the fishplates are forced against and cemented to the web of the rail. This pressure is accomplished by a system of levers. The poles of the transformer, the tie plate, and the web of the rail are between the lever jaws. By such an arrangement of levers and screws a small force applied to the hand wheel exerts a pressure of 400,000 lb. at the weld. Under this pressure a union of the pieces is obtained and the welding completed. The current is then cut out, the machine is lifted by the electric derrick, and the operation is repeated at another joint.

Photography Afloat.

Photographers who practice their art afloat during the yachting season may be glad to know that negatives can be safely and effectually freed from hypo by soaking in sea water. I have treated many plates in this manner during the summer with perfect success. I rinse off the negative on removing it from the fixing bath, and then leave it for some hours or all night in a washing box attached by a line to my yacht as she lies at anchor.

The box is a simple affair, loaded with lead on the bottom, outside, so that its top is level with the water. Half inch holes are bored through the sides, with wire netting nailed over them to keep out eel grass and other floating matter which might damage the film. The plate lies on the bottom of the box, secured in place by buttons that come about an eighth of an inch over the edge. After this sea bath I rinse out the salt with three changes of water in a tray.

I do not advise an experiment with which I began—towing the box while under way; as the film was found at the rear end of the box in a state of pulp.

Boston, Sept. 11, 1893. A. D.

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THE H. W. JOHNS MANUFACTURING COMPANY'S EXHIBITS AT THE FAIR.

Among the most interesting features of the World's Columbian Exposition are the various exhibits of the H. W. Johns Manufacturing Co., represented in our first page illustration. The name of this company is inseparably associated with asbestos, its numerous applications having been made possible by their inventions and constantly increasing improvements in manufacturing processes during the past 25 or 30 years. The materials produced by this company are necessary in nearly all branches of mechanical industry, and are of such great variety that to intelligibly illustrate their various forms and applications, it was found necessary to display them in six separate departments, distributed in four of the main buildings of the Exposition. A visit to these various exhibits will convey an idea of the important position which asbestos has taken among the industries of the world.

The company's general exhibit is situated in the northeast corner gallery of the Manufactures building, and consists of a comprehensive collection of the numerous specialties made by the company. This space is partially surrounded by a white colonnade, adjoining which is a conspicuous tower composed of various kinds of asbestos sectional coverings. These coverings are designed for use on steam pipes, etc., as non-conductors, being one of the many forms in which asbestos is supplied for this purpose. Other types of covering are shown in the form of a plastic material combining the properties of a felt and cement, for use on boilers, domes, large steam and other pipes, etc.; also in rolls or sheets similar in texture to hair felt, but composed partially or entirely of asbestos, and absolutely fireproof. Each different style is adapted to meet special requirements of heat insulation, durability, strength and lightness, from low pressure steam heating pipes to superheated surfaces in power plants, on locomotive and marine engines, etc. The practical application of some of the asbestos heat-saving coverings is shown in upper left hand corner of illustration, as employed in the power plant of the Exposition, which will be mentioned hereafter. The high non-conducting and fireproof qualities of the mineral are so universally recognized that there are now no approved forms of heat-insulating covering which do not consist wholly or in part of asbestos. In this exhibit are shown many forms of gaskets, or packings, for forming steam-tight joints, made from pure asbestos sheets and cloth; also a variety of wound cloth, twisted and braided asbestos piston rod packings, fireproof asbestos roofing materials, etc.; but an object of special interest is the handsomely decorated asbestos curtain, so hung as to form a pleasing background to this exhibit. Although made wholly of stone, this curtain is as flexible as any other woven fabric, and is unaffected by fire. Asbestos curtains are now in general use throughout the United States, all prominent theaters being equipped with them. They are generally used as drop curtains; scenery, flies, etc., are also made from the cloth. Other objects of interest are masks, fire shields, gloves, etc., for use in smelting works, iron and steel furnaces, etc., as protections against fire, heat, and red hot metals. A fire escape ladder made from the pure fiber hangs from one end of the structure. The large number of articles in this exhibit form an interesting collection, suggesting future possibilities of use for this mineral, which, but a few years ago almost unknown, is to-day to be found in some form in every factory, public building, or structure of any kind.

There are two exhibits of the H. W. Johns Manufacturing Co. in the Mines and Mining building. The principal one is on the main floor near the center, and is depicted in the center of our frontispiece. This shows machinery in motion, illustrating one of the processes of manufacturing asbestos. Here may be seen the separation of the fibers from the rock, the spinning of yarns, and the weaving of cloths. Various finished products from the mineral are shown, including a handsome curtain, similar to the one described above. The other, known as the technical exhibit, is in the gallery on the western side of the building, in a large case, and consists of specimens of asbestos ores from all parts of the globe—a rare collection, and one of great interest to the mineralogist.

In Machinery Hall may be seen the great pipes of the Exposition's power plant. These steam pipes, leading to more than fifty engines, the connecting pipes to the long battery of boilers, the main steam pipe and branches and many minor connections throughout the buildings are covered with H. W. Johns abestos coverings.

In the handsome pavilion shown at the top of the page is an elaborate exhibit of the paints, etc., manufactured by the company. The materials here exhibited comprise all paints, varnishes, stains, etc., used for exterior and interior decoration, including shingle stains, wood stains, fine colors in oil, varnishes, wood fillers, floor paints, roof paints, fireproof paints, etc. The practical uses of all the above articles are shown in the treatment of the structure, the interior of which is ingeniously wrought in panels, columns, friezes, etc., decorated with colors, stains and varnishes. H. W. Johns liquid paints have a world-wide reputation and command a higher price than any other.

In addition to the well-known fire and acid resisting qualities of abestos, the fiber in its pure state is recognized as one of the best electrical insulators known, and the company's sixth exhibit, illustrated in the accompanying sketch, shows a great number of forms of insulation. It is situated in the west gallery near the center of the Electricity building. One of the most important products of asbestos is vulcabeston, which is a strong, tough, fibrous material composed of asbestos and India rubber vulcanized. Vulcabeston is the standard insulating material for magnet spools, bushings, washers, armature rings and other parts of electrical apparatus, especially where subjected to mechanical injury, and is used in dynamos, motors, arc lamps, switches, street car controllers, rheostats, etc. Mica, like asbestos, is also an excellent insulator for certain electrical purposes. From this is manufactured the so-called moulded mica, which is composed of flakes of mica and adhesive insulating substances moulded under pressure. Moulded mica is used in insulating the well known trolley line materials. It furnishes the insulation for waterproof incandescent lamp sockets and rosettes and is made in a variety of forms for special purposes. To meet the requirements due to recent improvements in trolley line construction, the insulating material must be of the best, and all parts must be amply strong to endure the strains of overhead suspension. This company's insulators are designed for such conditions, being exceptionally substantial and durable. They insulate the greater part of the trolley lines in the United States. Samples of insulating pieces and electrical apparatus are shown,

THE WORLD'S COLUMBIAN EXPOSITION—ELECTRICAL GOODS EXHIBIT OF THE H. W. JOHNS MFG. CO.

fully illustrating the applications which have been made and comprising the most extensive and complete collection of electrical insulators ever exhibited. The large generators of the Westinghouse Electric and Manufacturing Company, furnishing current for the thousands of lamps which illuminate the grounds and buildings of the Exposition, are insulated with vulcabeston, showing another interesting illustration of the practical application of the goods exhibited by the H. W. Johns Manufacturing Company.

It is worthy of remark that the H. W. Johns Manufacturing Company occupy a unique position in the Exposition, having the largest number of exhibits of any manufacturer.

Potential of the Atmosphere.

What is the difference of potential between the air at the top of the Eiffel tower and of the ground at the foot? This is the question, interesting alike to electricians and to meteorologists, which has been put to and the answer sought by M. Chauveau, of the Meteorological Department at Paris. The result is rather astonishing. One would expect a few volts difference of potential—even a few hundred volts. But the answer is 10,000 volts! This certainly seems extraordinary at the height of 1,000 feet only, yet on a recent visit to the Eiffel tower one of our representatives, says the London *Electrical Engineer*, saw the attendant at his tests, and the amount was then over 7,000 volts. A noticeable spark, clearly seen and heard in broad daylight, of some millimeters length, was taken from the outside knob. This apparatus is of the simplest, but accurate means of measurement are installed. A Thomson battery of several hundred volts as standard, a reflecting potentiometer, and a photographic register of the light spot are the means used for obtaining the curves of rise and fall of potential. Plotted against curves of thermometer, barometer, and hygrometer, this will probably tell an interesting tale.

The means of obtaining the potential of the surrounding air adopted is that suggested by Lord Kelvin, of discharging fine streams of water. A small tube attached to a cistern of water projects out into the air for some six or eight feet. The tube and cistern are very carefully insulated, and a wire is led down to a knob within reaching distance, also highly insulated. On turning on the water jet a fine stream of water floats away on the air. In a minute or two the whole apparatus, which has some considerable capacity, is charged and sparks can be obtained. In registering, a wire is carefully taken through into the dark room and registers automatically in the way mentioned. M. Chauveau devotes a good deal of time and attention to this interesting experiment, mounting the Eiffel tower, every day, rain or shine, and on some days in winter, when the wind blows a perfect gale, this is by no means a pleasant or even a safe task. In winter, of course, the reading is very difficult, for the water freezes, and the other way to obtain the potential, by means of a gas flame, is not less troublesome. Sufficient curves have been taken, however, to lead to interesting results. The potential rises and falls in well defined curves, and very nearly a year's records have been obtained. The potential varies very much—from 3,000 to 7,000 volts is common—and on a brilliant, clear day, at this time of the year, 10,000 volts, we were told, was not uncommon.

The Schneider System of Cremation.

The system of cremation used in the new cremation urn at Cypress Lawn Cemetery, San Francisco, is that invented by Richard Schneider, an engineer who lives in Dresden, Saxony, says the San Francisco *Examiner*. It is the same introduced within the last year at Hamburg, and is probably the best process yet known. Under the Schneider system fuel is put into a gas regenerator and lighted, and when the gas is formed it is mixed with air. During the process of combustion the flame heats the fire-bricks which wall the incineration chamber, and the products of combustion, after passing through the chamber and a fire-clay grating, are carried off through a flue. After the fire has been burning for some hours the regenerator becomes bright red and the incineration chamber shows a white heat. Then the operation of reducing the human body to ashes may be commenced. The body is placed in a marble sarcophagus, which stands in a niche at the right of the main auditorium of the crematory. A button being pressed, the body is lowered by machinery into the preparation room, where it is stripped and wrapped in a sheet soaked in alum water. It is placed in an iron receptacle whose bottom is covered with a solution of alum and water. The door of the incineration chamber is then swung open and the body is given to the consuming heat. Through an opening in a door of the chamber the official in charge of the operation closely observes the progress of the incineration, and when it is concluded he reverses the gas and air valves and the ashes fall into the ashpit of the crematorium. No fire is visible. A rosy light, the product of more than 2,000 degrees of heat, plays around the shrouded form. No sight could be more impressive, few more beautiful.

A Royal Household.

Whitaker's Almanac for 1893 contains a vast amount of useful information. Some of the details relating to the Queen's household are very curious. The Lord Steward receives £2,000 a year for his services, as does also the Lord Chamberlain. The Examiner of Plays draws £320 per annum; the Bargemaster receives £60; the Keeper of the Swans gets £30; the Pages of the Back Stairs, £250; the Pages of the Presence, £200; Pages Men, £100; Royal Housekeepers, £120; Master of the Queen's Band, £300; Physicians in Ordinary, £200; Dentist to the Household, £70; Poet Laureate, £72; Clerk of the Closet, Chapel Royal (Bishop of Rochester), £7. The Master of the Horse is a very important personage indeed, receiving £2,500. The Equerries in Ordinary draw £500 to £600. The Bedchamber Women get £300. Some of the titles sound strange to American ears, as: Gentleman Usher of Black Rod, Painter in Ordinary, Surveyor of Pictures, Master of the Music, Her Majesty's Body-Guard of Yeomen of the Guard, Serjeant Trumpeter, Hereditary Grand Almoner, Lady Rider, Master of the Buckhounds, Whippers-in, Acting Mistresses of the Robes, Groom of the Robes, Lord Warden of the Stanneries, and Groom of the Stole (household of H. R. H. the Prince of Wales). These positions, in many cases, are filled by titled noblemen and ladies of high degree.

A Cap for the Obelisk.

Cleopatra's Needle, or the Central Park obelisk, is to have a gilded cap. It has been found that obelisks were originally provided with a top covering. The park commissioners have empowered the purchase of an aluminum cap, which will be gilded. The obelisk is now being treated again, so that it will stand the rigor of our climate.

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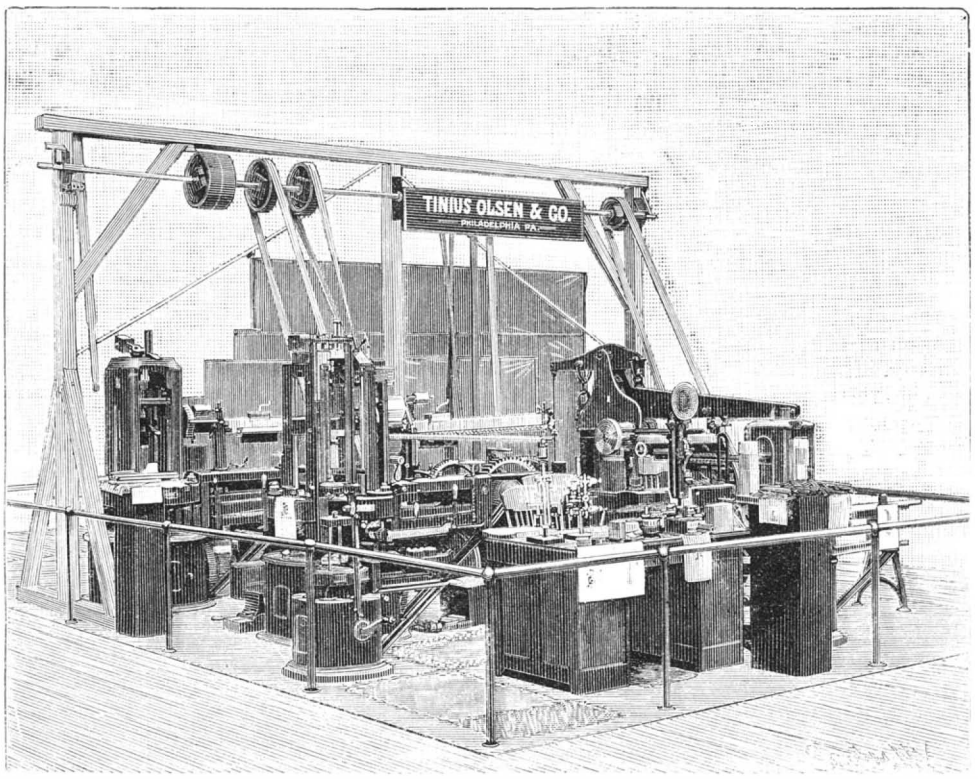
THE OLSEN TESTING MACHINES.

The exhibit of Tinius Olsen & Co. at the World's Fair, in Machinery Hall, includes a new autographic and automatic testing machine which registers up to 100,000 pounds; a new torsional testing machine which will test bars up to two inches in diameter and sixteen feet long; a cross section testing machine for cast iron; a wire and band iron testing machine, which was largely used in testing wire for the electrical department; a cement-testing machine, etc. Mr. Olsen has invented and patented a great number of improvements in testing machines and instruments, and in 1890 the Olsen testing machine received the Elliott Cresson medal and was the subject of a highly commendatory report of the Committee on Science and the Arts of the Franklin Institute. In this report was noted the great ingenuity of the inventor, especially in providing "the mechanism which produces a graphic record of the test, similar to the indicator of a steam engine, and thus brings to perception at a single glance the variation in the strain of a number of specimens as well as the work required to break them." The Olsen Little Giant testing machine, in which tensile, crushing and transverse tests are made with great facility, has long been a great favorite. The firm also make instruments for indicating the point of elastic limit, a duplex micrometer measuring instrument, spring testing machines, cloth, paper and lubricant testers, etc. Their machines are used by some of the largest industrial establishments of the country, as the Baldwin Locomotive Works, the Homestead Steel Works, the Cramp Shipbuilding Company, the Pennsylvania Railroad, etc. The office and works of the company are at No. 500 North Twelfth Street, Philadelphia, Pa.

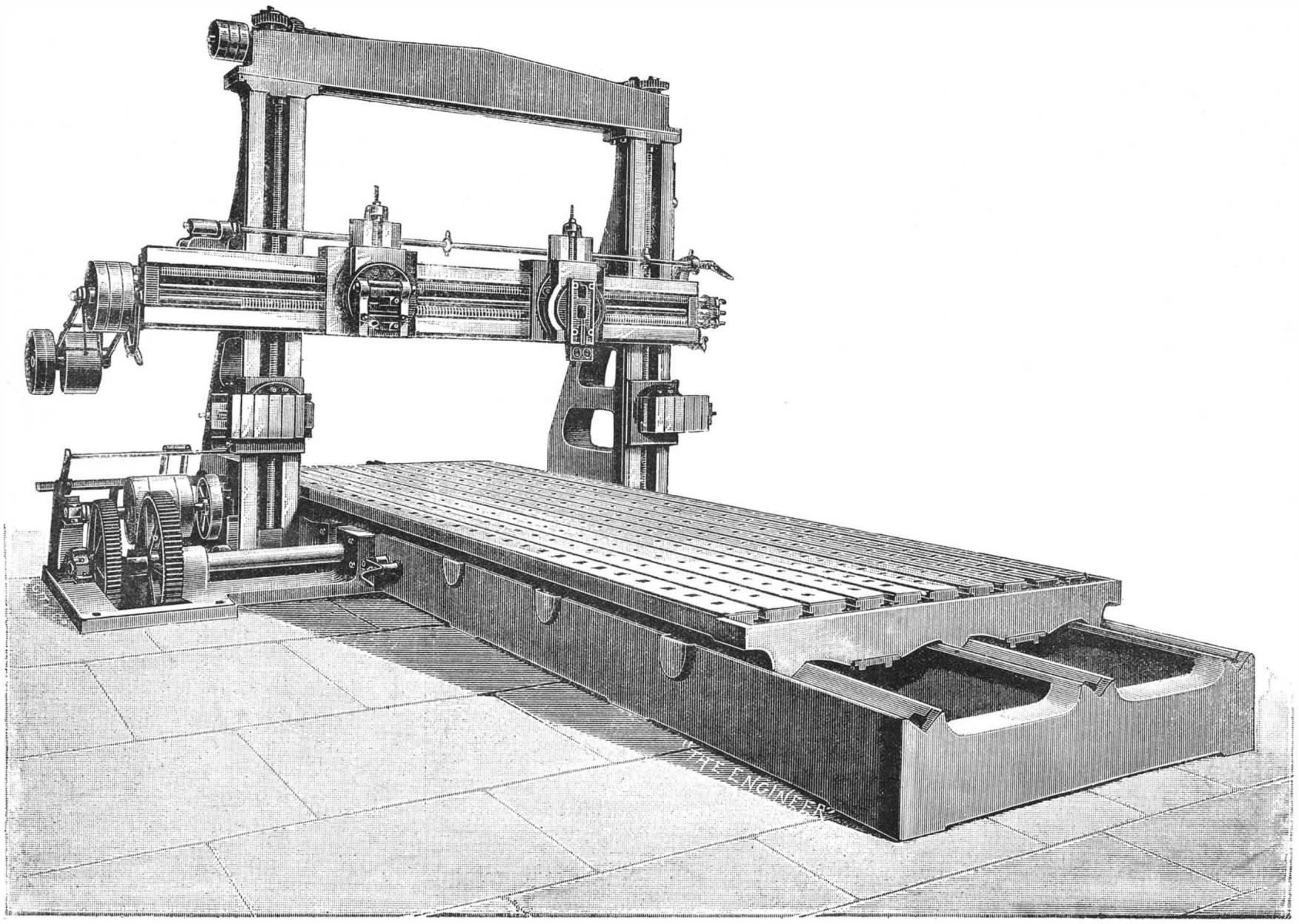


THE WORLD'S COLUMBIAN EXPOSITION—TESTING MACHINES SHOWN BY TINIUS OLSEN & CO.

A MONSTER PLANING MACHINE.

The machine which we illustrate in perspective elevation herewith is believed by the makers, says *The Engineer*, to be the largest and most comprehensive "table" planing machine in England. It is capable of planing a block 30 feet long, 12 feet wide, and 10 feet high over five out of its six sides at one setting. It would plane the top and sides of the block simultaneously with four cutting tools, two being carried by tool boxes on the cross slide and the other two being carried by tool boxes on each upright. These three sides would, therefore, be planed by the ordinary longitudinal motion of the table and the ordinary self-acting traverses of the tool boxes. For planing the ends of the block the ordinary arrangements would not apply, but on this machine there is in addition a cross planing motion to one of the tool boxes on the cross slide. When this is in action it gives a transverse cut up to 12 feet long across the table of the machine, and the tool box will feed vertically down the work, or the table of the machine may be advanced by a self-acting longitudinal feed motion. Thus the seats for the bushes and the facings for the flanges of engine crank shaft bearings, or any other surfaces lying in vertical planes at right angles to each other, or in horizontal planes between snugs at right angles to each other, can be planed at one setting. To express the capacity of the machine, in other words, while still referring it to the five sides of a cube, it may be said that the machine will plane a total surface at one setting of 1,200 square feet. Of course, in ordinary work the capacity of the machine is useful, not for actually planing the whole of these five surfaces, but for covering the whole of their length and breadth, so as to be able to plane a surface here and a surface there on the sides, ends, or top of a large casting at one setting, thus insuring the true parallelism or squareness of all the tooled parts.

Messrs. Buckton's own experience has proved to them the great advantage of having a planing machine of sufficient width between the uprights and sufficient height under the cross slide to take in as large a piece of work as can be carried by the railway companies. The largest cross section that will travel on the principal English railways may not exceed 12 feet by 9 feet, so that this seems to give a certain degree of finality to the maximum useful dimensions of a planing machine. For many engineering purposes also large surfaces require to be truly planed all over, and by ordinary methods one of the difficulties in doing this satisfactorily arises from the inevitable wear of the tool steel itself between the first cut and the last over a large surface. In the machine under notice this difficulty is met by the application of the patent double-cutting tool holder which has been successfully introduced by Messrs. Buckton. One of these tool holders is shown in the perspective view, in position for transverse cutting. When this tool box is in use there is no time lost in an idle return stroke, the planing goes on equally on both strokes of the machine, and the self-acting feed is made to advance the tool boxes for a fresh cut at each end of the stroke; so that, supposing the feed to be at the rate of twelve cuts to the inch, the tool box would



PLANING MACHINE FOR THE HASLAM FOUNDRY CO., DERBY.

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have taken two such feeds for each double stroke of the machine, and at the return of the table to its first starting position $\frac{1}{8}$ inch wide would be planed. By this double rate of progress divided between two cutting edges it results that there is theoretically only half the wear, but practically much less than half the wear, on the cutting edges between the first cut and the last over a large surface.

The advantages of the double cutting principle become more and more important, as the size of the surfaces and the weight of the articles become greater. The two-fold feed motion is effected by means of double ratchet wheels, which gives the power of feeding any of the boxes in any direction, as from left to right, or from right to left, or up or down, and to take that feed at each or either end of the stroke; so that the double feed arrangement gives advantages even upon work to which the double-cutting tool boxes may not be applied. The feed motions take place in advance of the belt-throwing motion, and the feed knocker fork is independent of the belt knocker fork; it follows that the machine may be stopped and started at any moment without disturbing the feed pawls and without marking the work. There is a belt-throwing handle at each side of the machine, and there are two bars on the American plan to throw a cross and open belt, one at a time, and to throw each one the complete width of the pulley face, neither more nor less, with a positive and invariable action. The bed of the machine is 45 feet long. The uprights and gearing plates are bolted to it, so that the machine is entirely self-contained. The bed has three parallel V guides for the table to slide in, and the V's have oil pockets at 5 feet pitch apart, fitted with miter disks supported on springs which roll the oil on to the V's of the table as it passes over them. The table is driven by two parallel steel racks with straight teeth, through double purchase steel gearing.

The table is made in two pieces with a single transverse joint, so that when a continuance of work is in hand, not requiring more than a 15 foot stroke, one half of the table may remain stationary at one end of the bed, and may be used as a setting-out plate or for erecting work upon. The transverse cut on the cross slide is driven by cross and open belts, with belt-throwing and feed motion similar in principle to those of the table.

The countershaft for driving this motion is attached to the cross slide by radius bars, so that the belts are of uniform length and tightness whatever be the position of the cross slide. The cross slide can be raised and lowered on the uprights by belt power and reversing gear. Machines of equal width to this, and in most respects similar, have been made by Messrs. Buckton for Messrs. John Brown & Co., of Sheffield, for planing armor plates, but the traveling table of those machines was 20 feet long, and this is the first machine on record that the makers know of having a 30 foot long table which will also admit of 12 feet between the uprights and 10 feet under the cross slide. Its capacity to use eight cutting tools, *i. e.*, four on each stroke, and to cut transversely in both vertical and horizontal planes, makes it still more unique.

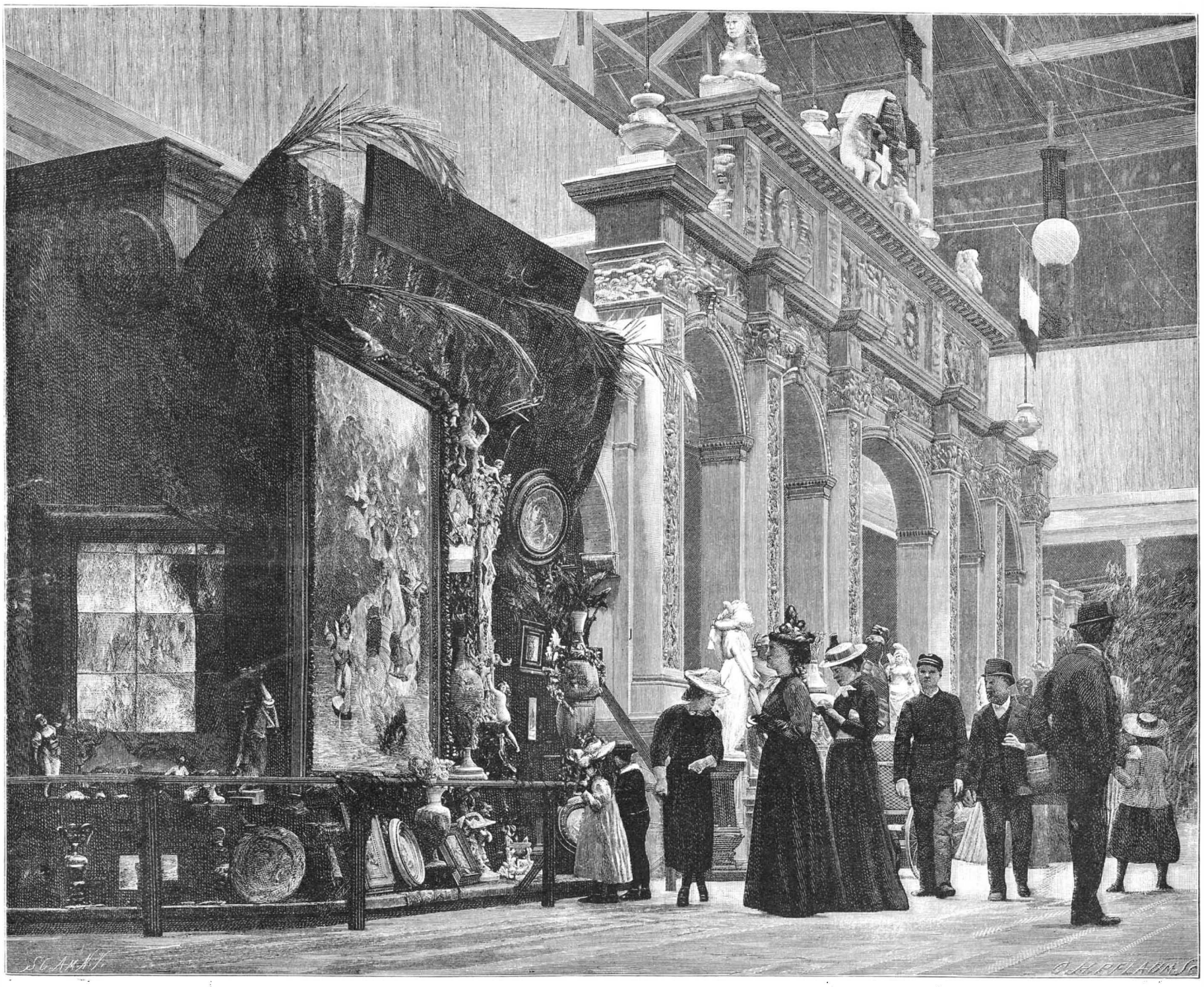
Devonshire Cream.

Persons on their return from their travels abroad express surprise that they can never get at home such delicious cream as they have in England and Scotland. It is known as Devonshire cream, and not many people, in this country especially, know what it is, but suppose it to be the particularly rich cream of the county in question, whereas every American housekeeper may have Devonshire cream on her own table if she will take the trouble to prepare it. Rich new milk is put in a very shallow vessel with an extended surface, and is then set on the range, where the milk will be warmed, but on no account must it boil or even scald. The heat will cause all the cream to rise to the surface in a very short time, and the pan is then taken off and placed in the ice box or in a cool place. When thoroughly chilled the cream may be taken off and will be nearly of the consistency of newly made butter. This is put in jars, and at breakfast is helped with a spoon and is delicious with oatmeal, jams, berries—everything in fact that ordinary cream is used for, its merits being that not only does one obtain the richest cream, but it will keep for two or three days without becoming sour. Why this English dainty is not used in this country to the same extent as in England is to be wondered at, but our dairy folk seem to know nothing about it.

THE WORLD'S COLUMBIAN EXPOSITION—THE ITALIAN EXHIBIT.

The kingdom of Italy has made a very creditable exhibit in the Palace of Manufactures and Liberal Arts. The exhibit is not large, but the wares placed on view show conclusively that the people of modern Italy have inherited a share, at least, of artistic ability from the glorious old masters. In fine mosaic, glass and lace work Italy excels, and her marbles, which are in many cases made by unknown artists, might well grace the home of the millionaire. Bronzes, tapestries and silken fabrics are largely made in Italy. Our view represents the entrance to the main exhibit of Italy from Columbia Avenue, as the central aisle of the Manufactures building is termed. Italy has also an annex at quite a distance from the main exhibit. The large picture at the left is really made of painted tiles of the usual size, the colors being fired in. The exhibit of lace made by a Venetian house is very fine and was much admired by the Duke of Veragua. There are several exhibitors of the curious ragged terra cotta figures called lazzaroni. The Italians excel in wood carving and fine cabinet making. Some of the examples exhibited are superb. It is really surprising to see how moderate some of the pieces of statuary are in price. Skilled labor can certainly be obtained at low rates in Italy.

The names of the exhibitors show their nationality, as Roccheggiani, Pasqualetti and Trilli. The exhibit of jewelry and small *objets d'art* is very fine and may be favorably compared with the larger exhibit in the same line made by France. The position of the Italian exhibit, being at the extreme south end, is rather unfavorable, as a portion of the exhibit is under the gallery and is, therefore, badly lighted.



THE WORLD'S COLUMBIAN EXPOSITION—ITALIAN EXHIBITS—PALACE OF MANUFACTURES AND LIBERAL ARTS.

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The Preservation of Paintings and Drawings.

In the report of the commission on the action of light on water colors, it is pointed out that every pigment may be said to be permanent when exposed to light *in vacuo*, and the commissioners observe that "this indicates the direction in which experiments should be made for the preservation of water color drawings." Numerous experiments and practical trials have been made with a view of preserving works of art of this class from atmospheric deterioration by the exclusion of the atmosphere from their surfaces. The difficulty, however, appears to have been that hitherto no means were employed for detecting a leakage of air into the vacuum chamber, so that an unsuspected pinhole or the slightest infiltration of air through any undetected cause would destroy the vacuum and entirely mar the result. It was to remedy this defect, says the *Times*, that Mr. W. S. Simpson, C.E., set himself to work, and he has devised a very simple and effective means of overcoming the difficulty. He incloses the picture to be preserved in an air-tight casing, the front of which is glazed, there being a space between the face of the picture and the glass and another space at the back of the picture. The air is extracted from this casing, the extraction being effected by a Sprengel pump, and the small tube through which the air is extracted is hermetically closed directly the desired vacuum has been formed. The most important part of the invention, however, and that by which Mr. Simpson has rendered the vacuum system of preservation practicable, is a small indicator, on the principle of the aneroid, placed inside the casing, but out of sight. This indicator has a small arm which is visible before the chamber is exhausted, but which disappears out of sight and is hidden by the frame of the picture when the vacuum has been formed. Upon any leakage of air into the chamber occurring, the little tell-tale immediately comes in sight, thus again revealing the fact that the vacuum has become impaired, and enabling steps to be taken for remedying the defect without prejudicial delay. The whole arrangement is very simple, and the process of preservation practically consists in removing the painting from its original frame, placing it in an air-tight chamber, creating a vacuum, and replacing the whole in the original frame.

The American Standard of Living.

The fact is not only demonstrable, but stands proved and unquestioned, that the average standard of living is higher in the United States than in any other country in the world. The industrial masses, who embody the vital forces of the nation and represent its life and character, eat more and better food than the toilers of other lands, wear ampler clothing of superior quality, occupy larger and better furnished apartments, enjoy higher opportunities for culture, and find open avenues to advancement on industrial, social and intellectual lines. Every statistical investigation of the comparative condition of the world's workers brings into prominence the physical status of our own people. It is shown that the meat consumption here is more than thrice that of Europe for each individual, and fifty per cent more than that of Great Britain, the nation which takes most of the surplus meat of this country. More than seventeen pounds of cotton per head, and eight of wool, besides a liberal quantity of silk and linen, are required for each individual—two or three times as much as the average in Europe. A country containing less than one-twentieth of the world's inhabitants uses one-fifth of the wool in the world, and nearly as large a proportion of the cotton. In other words, the clothing required by an average Yankee would clothe an average family of the other inhabitants of the globe. This is not a guess, but a demonstration, as the world's supply of clothing material is approximately known. House room and furniture share in similar liberality of supply, and are supplemented by ingenious appliances for comfort and convenience in housekeeping.

Educational facilities, public and private, are extraordinary in extent and variety, including all that is comprehended between manual training exercises and post-graduate university courses, available alike to the child of fortune and the son or daughter of the industrious laborer. It is possible for the child of a common laborer to attain the highest honors of the university, as is constantly demonstrated in conferring the highest scholastic degrees. It is demonstrated that few of the more advanced nations in industrial skill and civilization pay wage rates two-thirds as high as ours, and many European states pay scarcely more than half as much. While a large part of this generous difference goes toward better living and higher intellectual development, much remains to the pecuniary credit of the individual, in home ownership or savings banks deposits or other property. A surprising illustration is furnished by the industrious and thrifty people of New Hampshire, whose deposits in savings banks alone average about one thousand dollars for each family, with nearly twice as many depositors as there are families.

This republican independence of spirit, this training of heads and hands, with generous living and thrifty surplus saving, inspires ambition for continued advancement, and insures the breaking of all barriers of class, which in foreign lands are chains of steel that bind to ancestral occupations and hold fast the birthright of caste. We have here a field of action which is at once an opportunity and an inspiration. This continent is a new world, furnishing at the same time a wide theater of action and a worthy inducement to effort. With every variety of climate, the result of altitude and situation, of configuration of surface and the course of adjacent ocean currents, all products of temperate and subtropical zones are certain rewards of labor. The vines of France, the olives of Italy, the fruits of Spain and the Mediterranean isles, are all grown on our southern and western coasts, while the cereals, fruits and vegetables of the temperate zone are produced in profusion elsewhere. Soils are equally various, in richness and in mechanical and hygrometric condition, available for the growth of almost everything required for use of man or beast.—*Dr. James Richard Dodge, in the Chautauquan.*

The New Mode of Constructing Foundations.

The method of converting a bed of sand into firm materials adapted for foundations, which Mr. Neukirch described before the American Congress of Engineers, is ingenious; but whether it is generally applicable, which the *Real Estate Record and Guide*, of this city, queries, remains to be seen. He converts the sand into a sort of concrete by forcing into it cement in powder through a pipe, by means of air pressure. The pipe has an internal diameter of about 1½ inches, and is drawn to a point at the lower end, in which there are three or more holes, of about three-eighths inch diameter. The upper end is connected by a bend and rubber tubing with the air pressure supply pipe in such a manner that the pipe can be raised, lowered, and moved while the air pressure is acting through it. In the air pressure supply pipe provision is made, by means of suitable branches and stopcocks, for connecting an apparatus which, by means of an injector device, enables any desired quantity of cement powder to be fed into the air current. The air pressure, together with the cement powder, issues through the small openings at the lower end of the lance pipe, and is driven with considerable pressure into the sand foundation. This is very mobile where it is entirely under water, and consequently the blowing in of the cement produces a motion in the foundation pit similar to that in a vessel of boiling water, steam bubbles instead of air bubbles being formed.

The cement carried by the air is retained by the wet sand and forms sand concrete. By the boiling motion an intimate mixture of the wet sand with the cement is effected. After the injection of air has ceased, the grains of sand, in subsiding, adhere very firmly together, and experiments have shown that a natural bed of sand, after having one-fifth of its volume of cement injected into it, will, after the operation, occupy a smaller space than before. This was shown by the fact that the surface of the sand concrete lay deeper than that of the surrounding natural sand bed. The introduction of the lance tube into the sand bed is effected by first blowing air through it, so that the air issuing from the lower end forces back the sand and in setting it in motion renders the sinking of the tube to considerable depths, such as 16 to 19 feet, readily possible in a comparatively short space of time; this operation is rather more difficult when the bed is not purely sand, but contains large stones, wood, etc. In this case it may be necessary to raise the tube again and to insert it at a different place, so as to avoid the obstructions. In order to insure a uniform mixture, the foundation pit is divided into small fields of from 8 to 12 inches square, and into each of these the required quantity of cement, which is ascertained by dividing the cubic contents of the field by the required proportion of the admixture, is blown. The lance tube is first sunk in each field down to the solid substratum by means of air pressure alone. When it has attained this depth, cement is supplied to the air current, and during the continued introduction of the cement powder the tube is slowly drawn upward until the required quantity of cement has been introduced.

A Dinner Under a Gasholder.

On the occasion of the opening of the new Strandvei works of the Danish Gas Company, situated near Copenhagen, and built to supply the migratory population of the city with cooking gas, a dinner to 120 guests, representing the local authorities, press, etc., was given by the company's engineer (Mr. F. D. Marshall) and his colleague (Mr. Cridland) on behalf of the directors. The banquet hall used for the occasion was the huge dome under the Intze gasholder erected at these works, which was lighted by a series of Siemens lamps; and the effect was most startling. Several of the guests, however, when they came to realize the situation, and were informed as to the quantity and weight of the volume of water above them, became rather alarmed, and were much relieved when the proceedings terminated. In the evening, upward of a hundred of the workmen employed in the construction of the works were entertained by the company at a supper served in the same place.

Lowest Cost of Mining and Milling.

In reply to a correspondent who asked how cheaply ore can be extracted and milled under the most favorable conditions, citing instances, the editor of the *Mining and Scientific Press* says:

The Treadwell mine in Alaska probably secures better results from low-grade ore than any other large mine in the world. The Treadwell is practically an open quarry. The report of the Alaska-Treadwell Company for the year ending May 1, 1893, shows that the quantity of ore crushed was 237,235 tons, yielding an average of $2.13 in free gold. There were 4,276 tons of sulphurets saved by concentration and 4,584 tons treated, giving an average of $41.28 per ton. The average for all the ore treated, including yield from sulphurets, was $2.94 per ton.

The cost of work last year is given very fully in the report. Mining (237,235 tons) cost for labor 39·60 cents; supplies, 20·74 cents; total, 60·34 cents per ton. Milling (237,235 tons) cost for labor, 18·37 cents; supplies, 25·60 cents; total, 43·97 cents per ton. Chlorinating concentrates (4,584 tons) cost for labor, $5.3432; supplies, $3.649; total, $8.9922 per ton. Averaging all costs on the ore mined, the result was: Mining, $0.60; milling and concentrating, $0.44; chlorination, $0.17; general expenses at mine, $0.07; San Francisco office, $0.02; bullion charges (freight, insurance, etc.), $0.05; total, $1.35 per ton.

Probably the cheapest milling of ore ever accomplished in the world was by the use of a roller mill at the Spanish mine, Washington Township, Nevada County, Cal., four or five years ago.

At this mine the vein averages 90 feet. The hanging wall is a slate, soft, shaly, and not well defined. The true vein is on the footwall and consists of solid quartz, 4 feet thick. It does not pay for working. The pay is found on the hanging wall side, which contains many veinlets and streaks of ferruginous quartz carrying gold. Where no quartz is to be found there is no pay. The slate on this, the west, side is talcose.

The main tunnel was in 1,200 feet. The vertical distance from the surface to the end of the main tunnel was 350 feet. One of the methods of extracting ore here was as follows: There was an excavation from the tunnel to the surface which acquired the form of an open cut with sloping sides, too steep for a man to stand on. A Chinaman, armed with a churn drill, was lowered by a rope. He drilled a hole which, when deep enough, was charged with about five pounds of powder and fired, causing a large quantity of the soft slate to slide to the bottom, whence it was taken out through the tunnel. The mine employed a foreman, two white men, and eight Chinamen, who extracted about 4,000 tons of ore a month—enough to keep the mill at work. The wages paid were: White men, $3 per day; foreman, $3.50; and Chinamen, $1.50 per day.

The ore obtained came out of the tunnel by gravity, the empty cars being hauled back by mules. The ore was passed through a Blake rock breaker and then ground in a Huntington roller mill, of which there were three of 5 feet diameter and one of 4 feet. The mills, which made fifty-eight revolutions per minute, were fed by Hendy automatic ore feeders.

The following record of one month's run of the mine may be taken to indicate the low cost of working the ore, and to show also how very low grade an ore may be profitably treated when the conditions are all favorable:

MINE—COST OF PRODUCTION.

[Run: 28 days' work produced 3,443 tons of ore.]

	Labor.	Supplies.	Total.
Extracting ore	$703.50	$113.41	$816.91
Delivering ore to mill	160.20	17.95	171.15
Dead work	105.20	10.93	116.13
General expense	78.35	1.95	80.30
Total	$1,047.25	$144.24	$1,191.49
Cost per ton	0·304	0·042	0·346

MILL—COST OF REDUCTION.

[Run: 24½ days reduced 3,443 tons of ore.]

Mill expenses	$227.32	$194.33	$421.65
Water for power	....	161.70	161.70
Handling ore	154.50	5.35	159.85
General expense	78.40	1.95	80.35
Total	$460.22	$363.33	$823.55
Cost per ton	0·133	0·106	0·239
Bullion produced	....	....	$3,138.55
Total expense	....	....	2,015 04
Profit			$1,123.51

It will be seen from this that the ore only yielded a trifle over 91 cents per ton, yet a profit of 32·6 cents per ton resulted. The percentage of profit was 35·8 of the total. In the previous month, 2,796 tons of ore were worked, which yielded $1.16 per ton. The profit was 56 cents per ton, or about 48 per cent of the total. The profit that month on a yield of $3,268.49 was $1,572.91. The cost of mining was 37½ cents and of milling 23 cents per ton.

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Water Tanks.

In a paper recently read before the Engineers' Society of Western Pennsylvania, on "Iron and Steel Water Tanks," Mr. W. C. Coffin stated that the most economical proportions for such were obtained when the height was equal to from two-thirds to the whole diameter. The height of settling tanks should be about a quarter the diameter. Stand pipes should have a diameter not less than one-tenth their height. The thinnest plates used in constructing such tanks or stand pipes should not be less than three-sixteenths inch thick, and the bottom plates should not be less than one-fourth inch to five-sixteenths inch thick. Dipping the plates in a hot bath of asphaltum before shipping protects the material better than any other method of painting. In painting the tanks care should be taken to see that the paint is of such a consistency that it will not scale off. This can be ascertained by dipping a piece of painted iron in cold and in hot water, and also testing it by a hammer.

NOVEL SCENE IN INDIA.

The illustration represents a scene which, it may well be believed, is not a very common one, even in India, where the greater portion of the population have had sufficient proofs of the danger to life from tigers to give them a wholesome dread of that animal. Our sketch, which is from the London *Graphic*, was made by a party traveling with the troops near Bombay. The captive tiger was in charge of a native, who was going around the country exhibiting him for such small sums as spectators might contribute.

A CAPTIVE TIGER IN INDIA.

The Periods of Incubation and Duration of Infectiousness of Zymotic Diseases.

A very valuable contribution to medical knowledge has been made by the report of a committee appointed by the Clinical Society of London, to investigate the periods of incubation and contagiousness of certain diseases. This inquiry, as the *Pacific Record* states, partakes somewhat of the nature of a collective investigation, and the quality of the committee was such as to warrant perfect reliance upon the accuracy of the work done. The report gives a complete list of all the cases in abstract form; but it is the general conclusions that will be of most interest to the medical profession at large.

The investigation of diphtheria showed that the usual incubation period does not exceed four days, and that it is oftener two days than any other period, while seven days may be set as the outside limit. The disease is undoubtedly communicable during its whole course and the duration of the infection period is very variable, although, as a rule, some unhealthy condition of the throat will be found to account for late cases of infection. While the disease is usually communicated by personal contact, there were found plenty of instances of infection through articles of clothing, furniture, or carpets, sometimes years after the original cases. Quarantine should certainly be continued for two weeks after apparently complete recovery.

Information regarding typhoid fever is somewhat unsatisfactory. Its usual incubation period is twelve to fourteen days, and the limits may be placed at nine and twenty-three days. It is infectious throughout its whole course and for at least a fortnight after convalescence. This last statement of the committee should not be taken for more than it is worth, for there is good evidence that the stools of convalescents from typhoid may contain the infectious principle much later than two weeks after convalescence has been established.

Although epidemic influenza is included in the report, it is much less interesting than the other diseases mentioned, because its infectiousness is not universally admitted and information regarding it is scanty. Its incubation period appears to vary from one day to five, and usually to be two or three days.

In fixing the incubation period of measles, the appearance of the rash was taken as a starting point, because of the difficulty of determining the time of beginning of the period of invasion. This would probably lengthen the actual time of incubation by about four days, but as given it is found to be fourteen days very exactly, more than three-quarters of the cases reported following exposure in thirteen, fourteen, or fifteen days. Exceptionally the interval may be as short as seven or as long as eighteen days. Measles is communicable throughout its course, and, as is well known, the contagion is active when the catarrhal symptoms first appear. Quarantine with disinfection may safely terminate three weeks after the appearance of the rash.

Mumps has a very long incubation period, and the majority of observations makes it very exactly three weeks, with a limit of fourteen days on one side and twenty-five days on the other. It is most infectious at the start, beginning four days before the parotiditis appears, and the danger of communicating the disease becomes gradually less for two weeks, when it may be considered to be over.

German measles or rotheln appears in from two to three weeks after exposure, its incubation period being very irregular. It is infectious two or three days before the rash appears, and in most cases quarantine need not be continued more than two weeks.

Scarlet fever has an incubation period that is measured by hours rather than by days. A large majority of the cases appear in from twenty-four to seventy-two hours after exposure; but a respectable number develop during the first twenty-four hours, and some are delayed as long as eight days. Infection begins with the earliest symptoms and is very active in the later stages of the disease during desquamation. Quarantine should be at least eight weeks, and in all cases as long as any desquamation continues. This is the disease which is of all most readily communicated by a third person, probably through the medium of the clothing. The mild cases, without eruption and but slight sore throat, are common distributors of the disease.

The labors of the committee served to confirm the old rule that twelve days is the usual incubation period of smallpox, although this time is sometimes reduced to ten or increased to fifteen days. The disease is communicable from the start until the last scab has disappeared; but the danger of infection is not great until the disease has become well developed.

Chicken-pox resembles smallpox closely in the features of the periods of incubation and infectiousness, except that fourteen days is the usual time of incubation rather than twelve. The danger of communicating this disease lasts until all scabs have come away.

The text-books give so much latitude to the incubation periods of contagious diseases, particularly the exanthemata, that the information obtained from them is of but little use, and it is an excellent thing to have some reliable and accurate rules for guidance in the important matter of quarantining not only those who actually suffer from contagious disease, but also those who have been exposed to it.

Treatment for Children.

In a recent number of the *Medical Record*, Dr. J. W. Huddleston, of this city, describes a very successful method of treating young children for diarrhea, without diet or medicine, namely, by means of injections of water. He simply washes out the little one in a very thorough manner. The infant, bared of shoes, stockings and diaper, is placed across the mother's lap face down, with the legs hanging by her side. Beneath the child's abdomen is a sheet of rubber cloth which is held snugly around its waist by the mother; the lower end of the cloth rests in a small tub placed beside the mother's chair. A two quart fountain syringe filled with a salt solution of nearly normal strength (six per cent) is hung about four feet above the baby. The water is at the temperature it flows from the faucet—*i. e.*, from 68° F. to 75° F. In the middle of the tube leading from the bag is a glass pipe which serves to show when the current is flowing freely. To the nozzle is attached a large soft rubber catheter (size No. 12). This is anointed with vaseline, passed up the baby's rectum and colon as far as it will go, and the entire contents of the bag allowed to flow through it.

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RECENTLY PATENTED INVENTIONS.

Engineering.

CANTILEVER BRIDGE.—Thomas C. Clarke, New York City. By this improvement it is designed to facilitate the construction of bridges of longer span than has heretofore been attempted, and with this view suspender girders are used, the members of which take up the compression which comes from the ties supported by the towers. The stays are also arranged upon converging lines to enable them to resist wind pressure, and an expansion joint is provided by which the bridge members are allowed to expand or contract without interfering with their proper action. The bodily movement of the girders from unbalanced loads is resisted by a peculiar arrangement of the stays.

DAMPER REGULATOR.—John H. Blake, New York City. A regulator to be connected with the boiler, and so affected by the boiler pressure as to automatically regulate the furnace dampers so as to keep an even pressure upon the boiler, has been designed by the inventor. The improvement may also be used for other purposes, such as operating pumps, mechanical stokers, etc. Weights are so arranged that when the pressure in the steam chest becomes too low an indicating piston will be moved to open a port and operate the damper, an excessive pressure opening another port whereby the damper is moved in the opposite direction. A novel mechanism is employed to effect a differential movement so as to move the damper only the required distance to maintain the proper boiler pressure.

Railway Appliances.

NUT LOCK FOR RAILS.—Henry Cohen and John W. Tharp, Memphis, Tenn. The screw bolt uniting two fish plates has a locking plate on its projected end, a radially grooved nut bearing on similar grooves in the plate. In the opposite face of the locking plate is a channel adapted to receive a locking pin, connected with which is a wing plate, the pin being inserted in a hole produced by the junction of the groove in the locking plate and a radial groove in the face of the nut. If the winged pins are made of rigid metal, the nuts may not be moved until the pins are taken out, but the pins are preferably of lead or other soft metal, when a lever wrench will split them and allow the nuts to be unscrewed.

CABLE RAILWAY PULLEY.—Carles A. Johnson, New York City. A main rim of the pulley, having flanges and elongated slots, holds within its flanges an auxiliary grooved rim made in readily removable sections. The pulley is especially designed to carry the traveling cable, and is arranged to prevent the rapid wear of the rim, while a worn-out rim may also be conveniently removed, a new one substituted without discarding the remainder of the pulley or disturbing its position in the journals. The removable sections of the auxiliary grooved rim are made of a hard metal, to prevent rapid wear.

Mechanical.

BENCH VISE.—Thomas B. Jackson, Salem, Oregon. On the under side of the work bench is a guide strip along which moves a sliding shoe connected by a diagonal brace with the lower end of the movable jaw, in which is swiveled the horizontal screw stem. The middle portion of this stem works in a screw-threaded plate in a front standard of the bench, and its inner end swivels in the brace near the sliding shoe. By this construction yokes or slides passing around guides are dispensed with, the shoe moving freely along the guide strip in such manner as to never get cramped or stuck and all the parts being readily accessible.

TENSION DEVICE FOR LOOM SHUTTLES.—Etienne Domenge, Paterson, N. J. In weaving silk it is necessary to regulate the tension of the threads with great nicety, which is the especial object of this improvement. The swinging flies have the usual thread loops, and the springs of revoluble spring drums connect the drums and flies, while spring-pressed studs serve as supports for the drums. Adjacent supports for the studs have squared holes in which enter squared heads on the studs. The device is applicable to the ordinary shuttles and shuttle guards, and facilitates the quick and perfect adjustment of the tension.

HACKLING AND PREPARING FIBERS.—Theodore B. Allen, Brooklyn, N. Y. A machine especially adapted for treating sisal fiber for rope making has been patented by the inventor. It comprises a machine which finally hackles the fiber and delivers it in the form of a large, properly treated sliver, and an initial hackling and combing machine delivering to the final machine, which consists of two ordinary differentially moving hackling chains or belts having the usual drawing and feed rolls. A table is arranged as an inclined trough in connection with the final hackling machine, between it and the combing cylinder, to support the fiber which passes continuously from the cylinder to the feed rolls of the hackling machine.

WIRE SPLICER.—John D. Thomas, Scranton, Pa. A device to facilitate the quick and effective splicing of broken trolley wires without solder is here provided, thereby saving time and preventing delays on the road. It consists of a spindle-shaped tube in the sides of which are apertures where are fitted serrated wedges or dogs, adapted to force the wire with great pressure against the inner surface of the opposite side of the tube.

Miscellaneous.

SAFETY DEVICE FOR ELEVATORS.—Frank H. Shurtz and Henry G. Swan, San Francisco, Cal. The elevator cage has lugs traveling in a vertical guide at each side of the shaft, pivoted angular blocks being located one above another for the entire height of each guide. The blocks are engaged by a chain supported by a spring-pressed bolt, and means are provided for automatically releasing the bolt from the chain in case of accident to allow the blocks to drop into the path of the lugs of the cage, whereby the cage will be instantly locked in place. The blocks may be readily reset and the attachment readjusted without the help of skilled labor.

FIRE GRATE.—Abraham Stroh, Freeland, Pa. This is a grate adapted for use with boilers and stoves of every style, its construction being such that the grate openings can be set or varied to have any desired air space opening, providing for the burning of the smallest or largest size coal or other fuel. It has stationary skid bars with lateral members and rider bars with lateral members held between the skid bars, the riders having longitudinal movement between the skid bars. Every piece of the grate is free to move loosely, so that there will be no crowding or straining, and the several parts can be easily assembled, and any portion readily renewed, if it should wear out or be broken.

FUSE LIGHTER.—William C. Matthews, Denver, Col. This device consists of a metallic tack, dipped in a mixture of gunpowder, glue, and water, which, when dried, forms on the tack a combustible body, or the mixture may be moulded around the tack, the whole being then covered with paraffine as a protection from moisture. The point of the tack is left exposed, and this point is thrust into the end of a fuse to be lighted, the match being applied to the head coated with a quick combustible.

GRAPPLE.—John C. Manning and Albert C. Wilson, Marshfield, Oregon. This invention consists of a pair of tongs with upwardly and outwardly curved handles connected by links, the middle link being attached to the hoisting rope. The device is of simple and durable construction and adapted to firmly grapple and hold an article while lifting or moving it from place to place.

FENCE POST.—William M. Black, Urbana, Ohio. This post is ordinarily all of metal, although portions may be made of wood, the body being U-shaped in cross section, with the lower end bolted to anchor tie plates. It is especially designed for use as a corner post or gate post, and may be adjusted in the direction of any side, and when used in a wire fence may be braced against any tension, the adjusting mechanism also facilitating the bringing of slackened wires of the fence under proper tension.

INTERIOR HOUSE FINISHING.—George Knower, Chelsea, Wis. This invention provides battens of peculiar construction, for use in connection with a padding of paper material, in making arched wooden ceilings, etc., so that on the shrinking of the lumber the padding and battens keep the joints closed and water and air tight. The improved ceiling is readily put up, is not expensive, and may be made highly ornamental.

WAGON BRAKE.—James Vanderveer, Middle Village, N. Y. This is a strong, simple and inexpensive device, readily applicable to any form of vehicle, but especially suited for farm and other wagons which carry heavy loads. Combined with the brake lever are toggle levers, one of which is pivotally connected with the brake lever, while a link pivoted to the toggle levers at their junctions is pivotally connected with a hand or foot lever. A shifting lever secured to the axle of the vehicle prevents any strain on the body of the wagon or the springs when the brake is applied.

QUILTER FOR SEWING MACHINES.—William H. Chapman, Bradford, Ark. An attachment readily applicable to an ordinary sewing machine is supplied by this inventor, being a simple and inexpensive quilting frame, enabling the quilt to be conveniently handled and turned in any direction, so that seams may be run straight or in such curves as desired. It comprises a track, carriage and quilting frame, with horizontally arranged link connection between the carriage and frame to support the latter and permit it to turn freely, springs normally holding the frame in alignment with the carriage.

KEYHOLE GUARD.—George Hisgen, Fort Plain, N. Y. This is a strong and simple lock attachment to lock the key or bolt in place, and at the same time form a guard for the keyhole to prevent opening the door by unauthorized persons. It has a slide with V-shaped offset, an arm engaging either the bolt and passing over the keyhole or engaging the key, there being a guideway for the slide, and a knob to move it with its offset and arm into or out of the door lock casing.

ICE CREAM FREEZER.—James K. Patterson, Crete, Neb. The cream cylinder of this device has at one side a pivoted scraper, and below is a pivoted cream pan projecting beyond, a hopper delivering to the projected end. With a refrigerating compound in the cylinder and cream in the hopper, the cream is deposited upon the cylinder as the latter is revolved, where it is immediately crystallized and removed by the scraper.

HAMMOCK SUPPORT.—Nelson G. Reynolds, Bangor, Mich. This support has oppositely arranged diverging legs and braces when in position for use, the legs having at their upper ends hooks from which the hammock is suspended. The device may be folded into very small compass when not in use, and is very strong, light and easily operated.

BRACE FOR USE IN EXCAVATIONS.—George S. Miller, Council Bluffs, Iowa. This device comprises two bars, one having a head and the other a series of apertures, a yoke being pivoted on the head, and a stop pin passing through one of the apertures, a link locking the two bars together. The improvement is designed to afford a simple and sure means of supporting planks in excavations, such as ditches, canals, etc., the brace being readily extensible for varying widths.

SUSPENDER END.—William Bloomberg, New York City. This is an improvement in straps adapted to be secured to the buckles to carry button pieces to connect with the drawers, the suspender end strap being made with an integral tongue to fasten the device to support the drawers, the strap and tongue being readily applied to the suspenders, and being very cheap and durable.

DISHCLOTH HOLDER.—Clara Abell, Baldwinsville, N. Y. This is an elongated wire frame, with tin backing, there being a spring coil or double loop at one end of the frame and hooks at its opposite end, thus forming a light and convenient device for holding the cloth when used in washing articles, without danger of scalding the hand by the hot water.

DOLL.—Frederick B. Schultz, New York City. This is a simply and strongly made jointed doll, in which springs are arranged in the body and connected by swivels with chains for holding the parts together, whereby the several parts may be turned without danger of disconnecting or breaking the jointing devices.

FINGER OR TOE NAIL CUTTER.—Edmund T. Mason, New York City. This is a manicure device which may be readily manipulated by one hand to cut and shape the nails. It may be conveniently carried in the pocket or suspended from a watch chain.

SPITTOON CARRIER.—Gerard B. Nagle, Revelstoke, Canada. A pair of tongs is pivoted on the end of a handle of suitable length, on which also is arranged an opening and closing device connected with the tongs, that the latter may be conveniently used to clasp the spittoon, when it may be readily lifted and carried away for emptying or cleaning.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

PHARMACEUTICAL PREPARATIONS, WITH THERAPEUTIC NOTES, FORMULÆ, DOSES, ETC. Philadelphia: John Wyeth & Brother. 1893. 8vo. Pp. 224.

This little book, though published in the interests of the trade, contains a vast amount of information which cannot but be of value to all physicians, pharmacists and chemists. The reading pages are written by practical chemists and the subject is frequently illustrated by graphic symbols, formulas, etc. Some of the new remedies are described by well-known physicians. Messrs. Wyeth are to be congratulated on the production of such a creditable work.

The Royal Edition of the *Architect, Builder and Decorator* for August contains several superb photographs of pleasing residences. The designation of "royal" is merited. In excellence of contents and beauty of typography the *Architect, Builder and Decorator* has no rival.

SCIENTIFIC AMERICAN BUILDING EDITION.

SEPTEMBER, 1893.—(No. 95.)

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2. Plate in colors showing the Queen Anne residence of W. H. McKnight, at Springfield, Mass., erected at a cost of $11,500 complete. Perspective views and floor plans. An attractive design.
3. A colonial dwelling erected at Rutherford, N. J. Perspective view and floor plans. A model design. Cost $3,476 complete. Mr. H. G. Ten Eyck, architect, Newark, N. J.
4. A cottage erected at Bridgeport, Conn., at a cost of $2,775 complete. Floor plans, perspective view, etc. Mr. A. M. Jenks, architect, Brooklyn, N. Y. An excellent design.
5. Engraving and floor plans of a Queen Anne dwelling recently erected for W. Q. Taylor, Esq., near Boston, Mass. Samuel J. Brown, architect, Boston, Mass.
6. A cottage at Allston, Mass., erected at a cost of $2,500. Floor plans and perspective view. A pleasing design. Mr. A. W. Pease, architect, Boston, Mass.
7. Floor plans and perspective elevation of a cottage at Allston, Mass., costing about $2,000. Mr. A. W. Pease, architect, New York.
8. A tasteful design for a smithy or blacksmith shop.
9. Illustration of a new English villa at Worcester.
10. View of an Italian courtyard.
11. The Fifth Avenue Theater, New York. View showing a section of the proscenium arch and a portion of the family circle, also an engraving of the old Fifth Avenue Theater, burned in 1891.
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Patent Electric Vise. What is claimed, is time saving. No turning of handle to bring jaws to the work, simply one sliding movement. Capital Mach. Tool Co., Auburn, N. Y.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(5377) E. F. P. writes: 1. I read that 1,800 volts were used in the execution of a New York murderer. According to that, it would be fatal to grasp the terminals of a battery of 1,800 Daniell cells joined in series. Would it? Again, as the voltage of a cell is independent of the size of the plates, if each of the above mentioned cells was no larger than a lady's thimble, the series should be equally fatal. Would it be? If not, why not? A. A constant voltage has very little effect on the human system. Sudden changes in potential in dynamo circuits, perhaps partly in themselves and partly by the production of induced currents, are the fatal elements. The batteries described would have very little effect, and would be perfectly safe. 2. I have a six-cell plunge battery that must have a voltage of nearly 12. Why do I experience no sensation whatever when I grasp its terminals? A. See answer 1. 3. Can a good D'Arsonal galvanometer be made to show the induction currents generated by moving a coil of copper wire through the field of a permanent magnet? If so, how should things be arranged so as to show the effect to an audience? A. Use very fine wire, so as to get as many turns as possible, and connect its ends to the galvanometer. Sweep the coil rapidly across the field close to the magnet poles. Be careful not to shake the galvanometer. 4. What advantage, if any, can be obtained by using a storage battery if (a dynamo being unobtainable) it must be charged by means of a primary battery? Would it not be better always to use the primary battery direct? A. A small primary battery can charge in a given number of hours a storage battery, so that a very heavy current can be taken therefrom for a less number of hours. It is virtually a concentration of many hours' action of the primary into a few hours' action of the secondary battery. 5. In computing the energy of a moving cannon ball or railway train I am directed to use the formula $K=\frac{Wv^2}{2g}$. Now, why use $2g$, since that quantity is exclusively an element of the laws of falling bodies? Isn't it possible to compute the energy of the ball or train referred to by a process entirely independent of gravity considerations? A. Energy is always referred to gravity considerations, and is expressed in foot pounds or other unit of vertical height and weight. The formula given reduces energy of motion to energy of position; position referring to height or advantage of position with respect to gravity.

(5378) E. W. L. writes: I am making a pocket battery, ¾ inch in diameter inside and 3 inches long, to hold 1 ounce of electropoion fluid. I want to know which is the cheapest and best way to protect the zinc so that it will last longer. I want it to heat a No. 40 platinum wire to incandescence, the wire having a small loop, and about ¼ inch long, the length to be heated being ⅛ inch. It is not to be heated steadily, but for a few seconds at a time, and will the battery do it and how long? The size of zinc and carbon is to be ⅛ inch in diameter and 3¼ inches long. A. Amalgamate the zinc with mercury. A very small quantity will suffice. The battery will exhaust itself when not in use. It

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should give a good current for 5 minutes when fed. The zinc is very small.

(5379) C. A. K. says: Will you kindly answer the following? 1. Ocean steamships on their trip east make better time than on the trip west. Is it due to ocean currents, offshore winds, or do they make the trip on the arc of a great circle? A. The ocean steamers follow great circle sailing as nearly as possible both ways. It is the prevalence of westerly winds and the easterly set of the Gulf Stream that counts favorably to the eastern trip. 2. To settle a dispute between two friends: A claims that Florida is larger than England, Wales, Scotland, and Ireland combined, B claims it isn't. Please give number of square miles of each. A. B is correct. Florida has 59,268 square miles; England, Wales, Scotland and Ireland 120,879 square miles.

(5380) L. I. S. says: Do you know of any method by which black sheet iron drums could be soldered with ordinary soldering copper without first resorting to galvanizing, or any other method by which same could be made watertight? A. By removing the scale at the joints by acid, or scraping, the iron can be tinned with a copper, sal ammoniac being used as a flux and tin as solder, and when made up, soldered, or perhaps a better way for riveted and lapped joints, dip the drums in hot coal tar or thin asphalt varnish long enough to allow the tar or varnish to penetrate to the seams, then drain and cool.

(5381) G. F. K. asks: Having heard so much in regard to the use of oil on water during a storm at sea, I would like very much if you could inform me what action the oil has in stopping the force of the waves, or in other words, what is the nature of oil with water? A. Oil forms a film over the waves, which prevents them from breaking, reducing them to the condition of smooth swells. It operates by preventing the dangerous breaking at the crests.

(5382) D. W. C. writes: In your SUPPLEMENT of August 26, page 14717, is an article entitled, "The Distribution of Refrigeration in Cities from Central Stations." I would like to know if it would be practical for a hotel having 40 horse power (water) always at control to refrigerate a room for cold storage and to manufacture its own ice, 300 pounds daily. Also what ice plant would best be suited for a hotel with the above power, say for the manufacture of 500 pounds daily? A. The operation of a refrigerating apparatus for the production of ice and for cooling storage rooms from a distant source of power is practicable, either by compressing air at the power station and transmitting through pipes to the cold rooms, and there expanding into the rooms, or through coils immersed in brine for freezing in pans, as used in the ammonia process for making ice. The operating of cold rooms by compressed air is much in use in England and on ships in the meat and fruit trade, also on some of the United States war ships. There are no refrigerating plants as yet in use in the United States, to our knowledge, that are operated by compressed air, although several projects have been named. The economy of the ammonia processes has probably stood in the way of progress in the air process, but where ample water power can be had, the economy of compressed air cooling becomes a most economical one. The transmission of electric power from a distant water power station is practicable for operating a refrigerating plant with air or ammonia. Address Delamater Iron Works, 81 South 5th Avenue, New York, as to compressed air plant, and Pictet Ice Machine Co., 26 Cortlandt Street, New York, as to ammonia plant.

(5383) W. M. P. asks: 1. How would you proceed if obliged to stop your engine, when steam was blowing off at the safety valve, and a heavy fire in the furnace? A. Open the fire door wide, throw a covering of coal thinly over the fire and start the pump feeding the boiler. If the gauge pressure continues to rise, slightly lift the safety valve. 2. State the most economical point in the stroke at which to cut off the steam in the cylinder, and demonstrate it by an example. A. The most economical point of cut-off in a steam engine varies with its kind and with the initial pressure. The least volume of steam in pounds of water evaporated in the boiler per horse power per hour is assumed as the measure of economy. The terminal pressure in the cylinder indicates in a measure the point of cut-off for various pressures. If it approximates near to the atmospheric line with an initial pressure of 100 pounds, one-sixth cut-off would be the economical point, while with steam at 80 pounds one-fifth cut-off, 60 pounds one-fourth cut-off, 50 pounds three-tenths cut-off, and so on.

(5384) J. B. B. asks: 1. How are close coiled spiral springs wound so they have such strong tension? A. The tension of helical coiled springs is due to the torsional resistance of the steel. The twisting of a small steel wire will illustrate the difference between the bending and torsional resistance. 2. How are steel letters for marking tools, etc., made—by cutting or stamping the annealed steel and then tempering? A. Steel stamping letters are made by punching the central parts with small punches suited to the various forms of the letters, by engraving and by filing the outside to the proper form. 3. What acids are used in etching German silver, brass, nickel, aluminum and steel? A. Use nitric acid diluted with water for all but aluminum, for which use acetic acid saturated with common salt. 4. Where can the report be obtained of the aeronautical congress held in Chicago, of which you made mention last week? A. The report of the aeronautical congress is not yet published. Address the secretary, Professor A. F. Zahm, Notre Dame University, Indiana. 5. Is there a practical gasoline road wagon, suitable to carry two persons at a speed of from four to twelve miles per hour over ordinary roads, now in use? and if so, give name and address of the makers. Also cost of machine if known. A. Road wagons run by gasoline engines are not yet on sale. They are as yet in the experimental stage.

(5385) G. R. C. writes: In a residence which I am building I desire to put in water closet and bath room. Our city has water works but no sewerage. How can I arrange a cesspool so that it will be perfectly safe? Our soil below the surface is hard clay, with no vein of sand or gravel, but we find water at a depth of about twenty feet. A. A city with water works and no sewers is in something of a dilemma in the manner of disposal of the larger quantity of sewage natural to a water supply system. If there are no wells it is safe to dig cesspools as deep into the water stratum as practicable for present use. If neighbors have wells drawing from the water stratum, then cesspools are more or less dangerous. If made, they should be shallow and tight and arranged for the convenience of pumping into tank carts for removal to a safe distance.

(5386) 7. B. B. writes: Why in two different formulas for waterproofing woolens there appears to be the divergence in application I now describe, thus: 1. *a* soap and *b* alum solutions. In this case the woolen is dipped first in *a* and afterward in *b*, the result being an insoluble combination in the fiber of the material treated. I understand the *rationale* of this. 2. *x* acetate of lead solution, *y* sulphate of alumina solution. I would have thought that in this case, as in case 1, the woolen would have been treated to an alternate dipping in each solution, allowing the combination and the resultant insoluble crystals to form in the fabric; but in this case the direction is to combine the two liquids, decant the supernatant acetate of alumina, leaving the insoluble carbonate of lead and soak the fabric in the acetate of alumina, leaving it to dry out. Will you please say how or why it is that the exposure to wet does not wash out the soluble crystal, if it would not be better to dip (and partly dry) the fabric alternately in case 2 as in case 1, or if you can advise that process 2 as above is really good, whether it would require oft renewing? It is certainly the cleaner process of the two, if it will only stand good, as long as process 1. A. The *rationale* of the first process is to fill the texture of the goods with alum soap, which is insoluble in water, and hence must be precipitated as described. The second process saturates the goods with a combination of aluminum with a weak acid. This salt is supposed to decompose and in a certain sense mordant itself within the fabric. Properly executed, the first process would seem most efficacious.

(5387) W. H. U. writes: 1. In using a warm cyanide solution with a gold coin or an anode, I get a slight coating on copper cathode followed by a deposit of brown incrustation which prevents all additional deposit, battery 5 Crowfoot cells. What is the trouble? A. Use a pure gold anode and connect your battery in quantity. 2. Approximately how much metal (brass or copper) can be deposited with dynamo described in SUPPLEMENT, No. 793, in a day's run, 10 hours. A. Allow one-quarter of a grain per second. 3. Is there any patent on storage battery recently illustrated in SCIENTIFIC AMERICAN? A. In our SUPPLEMENTS you will find many articles on this subject. No very prominent invention has been recently illustrated. 4. When a storage battery has been charged for some time, will it develop a current instantly or does it require time to get in full action? A. Practically speaking, it will.

(5388) D. B. H. asks: 1. Is the making of electrical instruments, galvanometers, etc., embraced in the machinist's trade, or is it a trade in itself? A. There are some special trades in mechanics that designate certain branches to which the term "machinist" is not generally applied, as watch and clock makers, electrical instrument makers, philosophical, optical, and mathematical instrument makers. The term "mechanician" has been very properly applied to persons pursuing the finer branches of the mechanic arts. 2. Does it require a steam engine of one horse power to run a generator of 746 watts to its full capacity? A. Yes.

(5389) J. R. C. says: Kindly state in your columns at what height an observer must stand to see an object thirty feet high, which is sixty-one miles distant across the water. A. The depression of the horizon for an object 30 feet high over the sea is 7¼ miles, which must be deducted from the total distance, which leaves 53¾ miles as the total distance to which depression of the horizon is due, which amounts to approximately 1,700 feet, including refraction. Different barometric and hygrometric conditions of the atmosphere make the total height somewhat variable.

(5390) J. J. P. asks: How much power will be required to run a sixteen foot boat, forty inches beam, seven miles an hour? What size propeller should be used? What speed could such a boat make against a current of five miles an hour? A. Three horse power. Engine cylinder 2¾×3¾ inch. Propeller 20 inches diameter, 300 revolutions per minute. The speed against or with the stream would be 2 miles or 9 miles.

(5391) C. T. B. says: Perhaps your correspondent T. D. D., Notes and Queries 5319, of September 19, 1893, would be interested in the article by George H. Knight, in the *Cosmopolitan Magazine* for September, page 620, relative to the practically continuous railway rails being laid at Cambridge, Mass., for an electric railway.

(5392) S. H. writes: I wish to convey hot mineral water from the hot springs to my house. The distance is about two miles and one-eighth, with about 50 feet full. I wish to know if you know of any one who makes an auger that will bore pump stocks from 8 to 10 feet long, and cleanse themselves, size 2 inch bore. A. Ames Manufacturing Co., Chicopee, Mass., manufacture pump augers and reamers for making wooden pipe and pumps.

(5393) D. B. K.—Your boiler for 12 gallons capacity should be made of ⅛ inch iron. The fire box should be ventilated by tubes, like other vertical boilers.

(5394) A. V. L., Texas, asks: What is the theory upon which the rain makers carry on their operations? Is there a sound basis to the theory, or rather, in which instances, if any, have they actually succeeded in bringing down a copious rain? The experiment was tried here last year, but did not succeed, and it is said that preparations are now being made for another trial. Many people seem to regard it as a piece of foolish nonsense and waste of money. A. The theory, as far as we understand it, is based upon the possibility of producing condensation of the moisture in the upper atmosphere into clouds, which are composed of minute vesicles of water, or, if clouds are in sight, to develop an enlargement of the water vesicles into raindrops by the intense vibration of the upper atmosphere, or perhaps, by the intense heat of the exploding gas, to create an upward current from a nearly saturated under current into a colder current, where, by contact with cold air, its moisture would be condensed and fall as rain. Where the conditions are favorable, as in a nearly saturated atmosphere, the experiments seem to have been successful in producing a shower. When the atmosphere was of a low degree of humidity, failure was the result. The idea was derived from the fact that rain has followed some of the great battles of the world, or, more probably, that some of the great battles were fought just before a storm.

(5395) J. W. V. asks: What can I use to keep planished copper and brass bright and what will clean them without much rubbing? Also what kind of a solution do the silversmiths use to clean their ware with and to keep it bright without rubbing? A. For keeping copper and brass utensils bright, there is nothing better than tripoli, rottenstone, or rouge, wet with a solution of oxalic acid in water, about one ounce to the pint, using a linen rag for a rubber. When polished, wash in hot water and wipe dry. This saves much rubbing, over the polishing material alone. Silverware cannot be kept bright without rubbing, which for plain goods needs nothing but wiping with a wash leather and Vienna lime or the finest chalk, such as used for cosmetics. For frosted and chased ware, a soft brush should be used charged with Vienna lime or fine chalk.

(5396) E. T. M. writes: 1. Will a windmill 8 feet diameter draw water from a distance of 40 feet horizontal by 25 feet vertical through 1¼ inch pipe, and force same through 1 inch pipe to height of 30 feet? A. The windmill will easily pump water through the pipes as stated. 2. Is there any kind of turbine or other wheel by which I could run a sewing machine with a fall of 25 feet water, something cheap and safe? Bottom of tank would be about 25 feet above sewing machine and water not plentiful enough to waste. A. A small water motor as made by the Backus Water Motor Company, Newark, N. J., will run the sewing machine. Address them for prices. 3. Do you know probable cost of such a small turbine for this purpose, or is there any other clean, safe method of running the machine whereby foot power could be avoided, and would a small gasoline engine be cheap and safe to pump the water distances mentioned in 1 and run the machine, not at same time, but each alone? A. A gasoline engine, i placed no higher than 25 feet above the water, will do the pumping and run the sewing machine. Address advertisers of gasoline engines in SCIENTIFIC AMERICAN.

(5397) R. G. M. says: I take the liberty of asking for directions for polishing horn. A. Use finely ground pumice stone and water, applied with felt polishing wheel; finish with rottenstone applied in the same way, or having scraped the work perfectly smooth and level, rub it with very fine sandpaper, repeat the rubbing with a bit of felt dipped in finely powdered charcoal with water; and lastly with rottenstone or putty powder and finish with a piece of soft wash leather, damped with a little sweet oil; or still better, rub it with subnitrate of bismuth by the palm of the hand.

(5398) W. L. F. says: 1. Will you kindly let me know what I can use to remove rust spots from white marble? A. Turpentine, 2¼ tablespoonfuls; lye, 1½ gills; ox gall, 1½ ounce; pipe clay, q. s. to make a paste. Apply the paste to the stain and let it remain for several days. Iron mould or ink spots may be taken out by dissolving in 1½ pint rain water, 1½ ounce oxalic acid, ¾ ounce butter antimony, flour sufficient to make the mixture of a proper consistency. Put on with a brush, let it remain a few days, wash off. Grease spots may be removed by applying common clay saturated with benzine. 2. Also something to remove moss from brown stone where flower pots have been standing? A. Mildew stains on brown sandstone are very difficult to remove except by refinishing, but the appearance of the stone can be improved by scrubbing the mildewed stones with a strong solution of caustic soda in water.

(5399) W. R., California, asks how the magnetic variation of the compass needle is determined. A. If you have a theodolite, a simple observation of Polaris at its upper or lower culmination will give the variation on the needle circle when the zero circle reading is vertically collimated with the axis of the telescope. Polaris is now 1¼ degrees from the true pole and opposite to the star Mizar, which is next to the last star in the handle of the Dipper. When Mizar is on the meridian either above or below Polaris, the polar axis is in the vertical line. When Mizar is at right angles to the west, Polaris is 1¼ degrees east of the true pole, and *vice versa*, so that a good observation may be always obtained within six hours after dark, by allowing for the three different positions of Polaris. If a compass is used, a plumb line should be hung from 15 to 20 feet from the compass, so that both compass sights will cut the line of sight of the plumb line and the rear sight and plumb line also in line with Polaris. Allow for the position of Polaris if at east or west elongation as above stated. The plumb line can be illuminated at the points of sight by lanterns shaded from the eye. Chalk the plumb line to make it easily seen

(5400) W. F. W. says: Will you kindly inform a reader what is the fastest time made on railroads in England and the United States respectively. Also the fastest schedule time in each of the two countries, and what improvement in time has been made in the last forty years? A. The fastest schedule time in both England and the United States is about 50 miles per hour. About 90 miles in England and 112 miles in the United States are the fastest spurts. Probably 25 per cent is the schedule increase in 40 years.

(5401) G. H. N. asks: 1. What is the difference in winding dynamos and motors? A. There is no difference. 2. What is the difference in winding dynamos for high or low voltage? A. The difference in voltage will be made by increasing or decreasing the length of wire in the coils of the armature. 3. What is the difference in winding for steady or alternating current? A. The difference between direct and alternating current machines is so great as to render it impossible to fully describe it in the space available in Notes and Queries. We refer you to SUPPLEMENT, Nos. 733 and 446. 4. What electrical magazine can I subscribe for that is not printed for the advertisements it can get and that will give me useful information, keeping me posted as to new inventions, etc. The SCIENTIFIC AMERICAN and SUPPLEMENT contain all of the important electrical news and more practical information than most purely electrical papers.

(5402) W. M. G. writes: I am making a storage battery and would like to know if the plates of a storage battery could be made of type metal and if the same would in any way affect the action of the battery? A. You can use type metal for storage battery plates, but we think the alloy would be improved by the addition of pure lead, as type metal is rather brittle and apt to be easily broken. An alloy of lead and antimony is now in use for secondary battery plates.

(5403) B. A. C. writes: I wish to connect a small dynamo used to charge storage batteries to a windmill. There is an abundance of power, but there is an irregularity of speed. Now, will the dynamo charge the batteries while running under different rates of speed? A. You must arrange an automatic cut-out to throw off the dynamo current in case the speed is too high or too low. A considerable range of irregularity is permissible. An automatic governor might be devised to regulate the charging current.

(5357) For "fifth" root in above query read "sixth" root.

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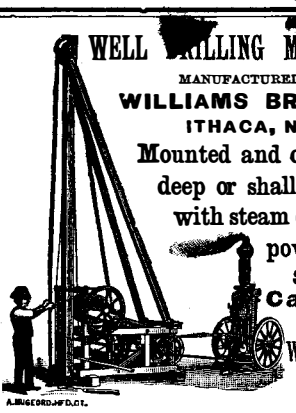

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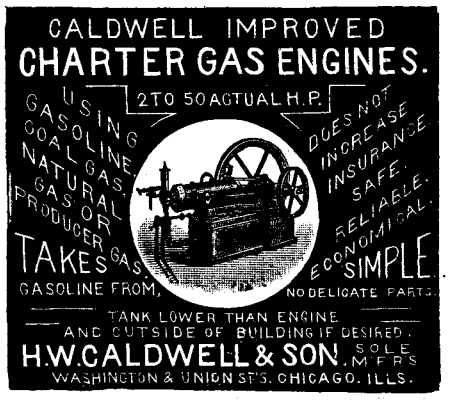
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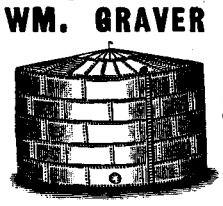

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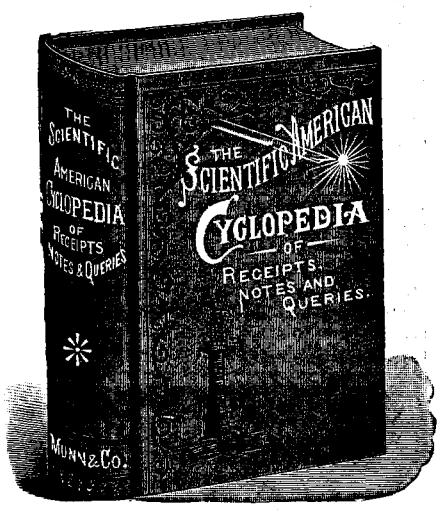

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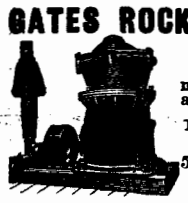

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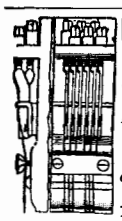

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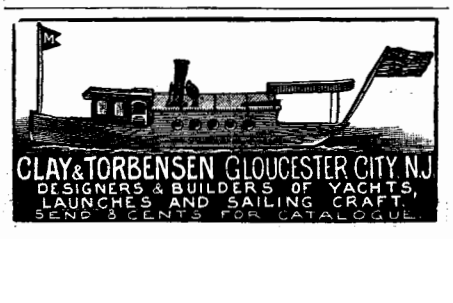

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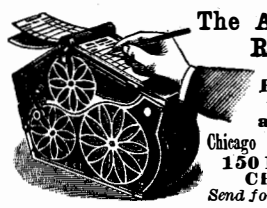

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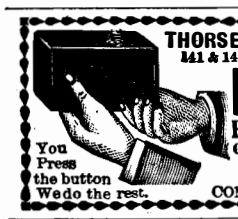

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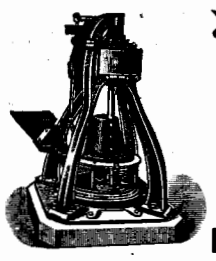

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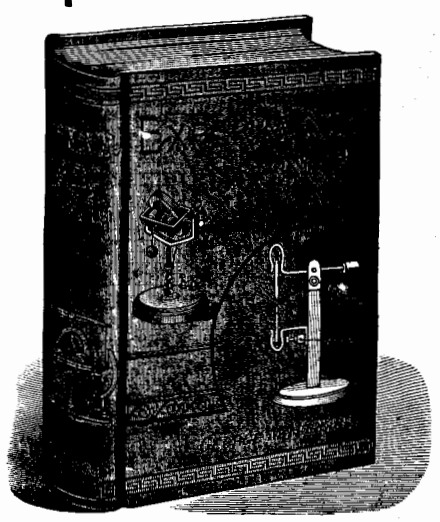

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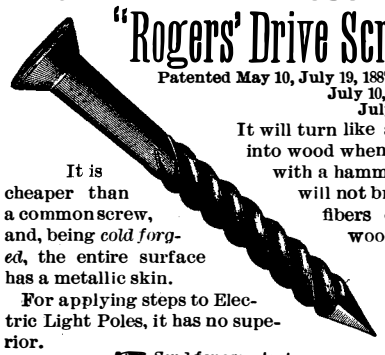

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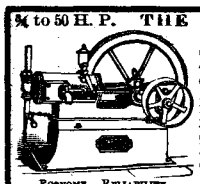

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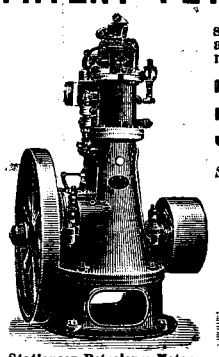

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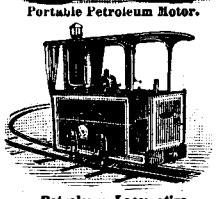

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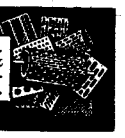

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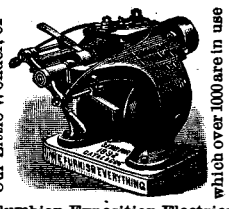

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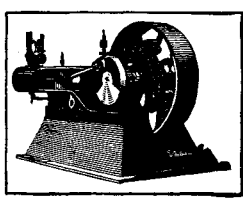

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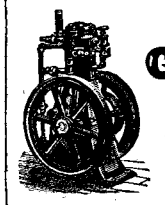

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